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VOLUME 4, Number 3 SEPTEMBER 1948

PRESENT METHODS IN THE TREATMENT OF INFANTILE PARALYSIS
*Wallace H. Cole*, M.D.

TUMORS OF THE BRAIN
*Winchell McK. Craig*, M.D.

PIONEERING IN ANESTHESIOLOGY
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*Scientific Exhibit*

CONGENITAL ANOMALIES OF THE HEART AND GREAT VESSELS, Part I.
T. J. DRY, J. E. EDWARDS, R. L. PARKER, H. B. BURCHELL, H. M. ROGERS, AND A. H. BULBULIAN

COMPLETE TABLE OF CONTENTS ON PAGE 5

*International Assembly—Public Auditorium, Cleveland, Ohio, November 9 to 12, 1948, 33rd Year*

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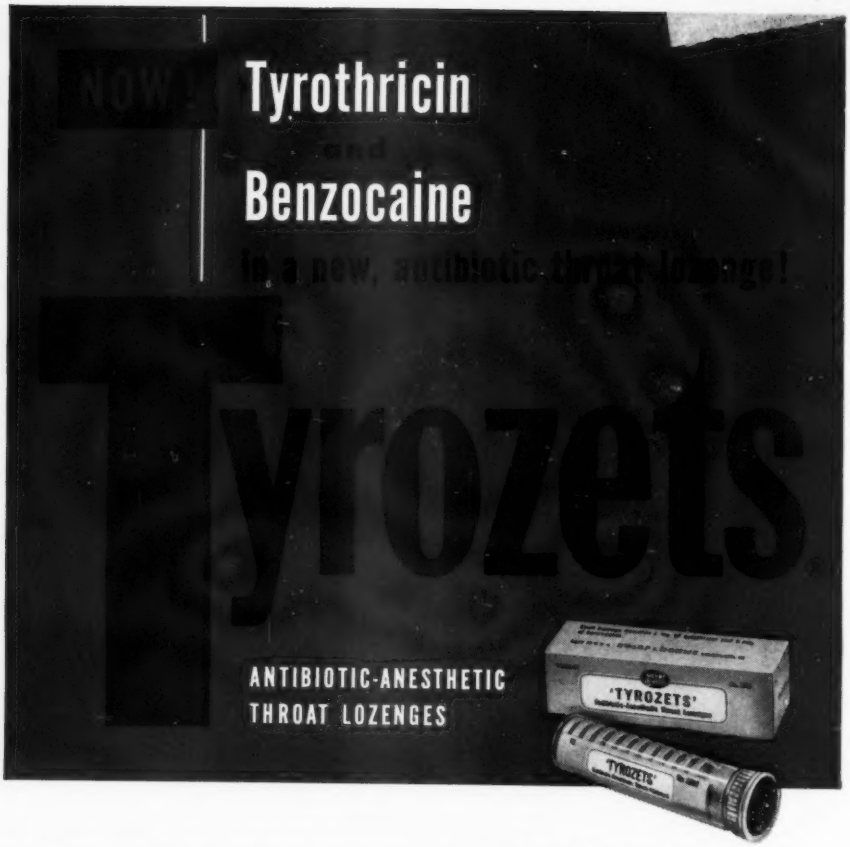


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SEPTEMBER, 1948 VOL. IV, NO. III

## Table of Contents

### *Special Articles*

PRESENT METHODS IN THE TREATMENT OF INFANTILE PARALYSIS.
Wallace H. Cole, M.D. . . . . 185

TUMORS OF THE BRAIN: Advances in Diagnosis and Treatment.
Winchell McK. Craig, M.D. . . . . 190

### *Diagnostic Clinics*

TREATMENT OF HEPATIC CIRRHOSIS.
G. O. Broun, M.D. . . . . 203

BODILY REACTIONS OF ANXIETY.
Franklin G. Ebaugh, M.D. . . . . 208

CHRONIC LUNG FAILURE.
J. D. Adamson, M.D. . . . . 217

THE MEDICAL MANAGEMENT OF HYPERTHYROIDISM.
Daniel L. Sexton, M.D. . . . . 224

### *Scientific Exhibit*

CONGENITAL ANOMALIES OF THE HEART AND GREAT VESSELS, Part I.
T. J. Dry, J. E. Edwards, R. L. Parker, H. B. Burchell,
H. M. Rogers, and A. H. Bulbulian . . . . . 231

### *Departments*

PIONEERING IN ANESTHESIOLOGY. Ralph M. Waters, M.D. . . . . 265
THE MEDICAL BOOKMAN . . . . . 271
EDITORIALS. *Gastric Cancer • Doctors of Happiness and Health* . . . . . 273
NEW DRUGS AND INSTRUMENTS . . . . . 276
LEAVES FROM A DOCTOR'S DIARY. Maurice Chideckel, M.D. . . . . 278

# Definite, Specific, Methods of TREATMENT

*A Symposium from Boston in the September Number of the*

## Medical Clinics of North America

**Treatment of Migraine**—By Dr. J. R. Graham, Massachusetts General Hospital.

**Investigation and Treatment of Infertility**—By Dr. John Rock, Harvard Medical School.

**Brief Psychotherapy in Medical Practice**—By Dr. William Malamud, Boston University School of Medicine.

**Penicillin in Treatment of Pulmonary Infections**—By Dr. William L. Hewitt, Massachusetts Memorial and Evans Memorial Hospitals.

**Recent Advances in Treatment of Essential Hypertension**—By Dr. E. D. Freis, Evans Memorial Hospital.

**Treatment of Anemia**—By Dr. C. P. Emerson, Jr., Boston City Hospital.

**Care of Patients Paralyzed by Spinal Cord and Cauda Equina Injuries**—By Dr. D. Munro, Boston City Hospital.

**Diagnosis and Treatment of Poliomyelitis**—By Dr. Louis Weinstein, Harvard Medical School.

**Nutrition in Protracted Disease**—By Drs. F. J. Stare, George V. Mann, and E. K. Caso, Harvard School of Public Health.

**Modern Treatment of Rheumatoid Arthritis**—By Dr. T. B. Bayles, Robert B. Brigham and Peter B. Brigham Hospitals.

**Treatment of Allergic Disease**—By Dr. F. C. Lowell, Boston University School of Medicine.

**Treatment of Rickettsial Diseases**—By Drs. A. Yeomans, Dartmouth Medical School, and J. C. Snyder, Harvard School of Public Health.

**Management of Urinary Calculi**—By Dr. H. I. Suby, Massachusetts General.

**Rheumatic Heart Disease with Periodic Arterial Embolism; Ambulatory Treatment with Dicumarol**—By Drs. H. B. Sprague, Massachusetts General Hospital, and R. P. Jacobsen, Evans Memorial and Massachusetts Memorial Hospitals.

**Repair Solutions in Treatment of Metabolic Acidosis and Alkalosis**—By Drs. C. H. Burnett and B. A. Burrows, Evans Memorial Hospital.

**Use of Antispasmodics and Spasmodics in Gastrointestinal Disorders**—By Drs. P. Kramer and F. J. Ingelfinger, Boston University School of Medicine.

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**Syndrome of Protruded Intervertebral Disk**—By Dr. E. Oldberg, University of Illinois School of Medicine, Chicago.

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# Present Methods in the Treatment of Infantile Paralysis

WALLACE H. COLE*

UNIVERSITY OF MINNESOTA MEDICAL SCHOOL, MINNEAPOLIS

IN ORDER to discuss the present methods in the treatment of infantile paralysis, it is necessary first to review, to a certain extent at least, something of the symptomatology and course of the disease in general and to explain why an orthopedic surgeon has been asked to speak on this subject.

The literature on poliomyelitis is so voluminous that it is with definite hesitation that one adds another discussion to the long list of titles comprising the bibliography of the disease, and many already published papers could be read here with greater benefit than anything I can offer. However, reiteration of the basic knowledge which we have, incomplete as it is, and a summary of the more accepted means of treatment can do no harm and may even be of some slight value. Until a specific agent has been developed against the virus of infantile paralysis, no standardized method of treatment is possible in the acute stages, and the symptoms only can be combated. What appear to be the best methods in this fight will be discussed briefly here.

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Presented before the meeting of the Interstate Postgraduate Medical Association of North America, St. Louis, Missouri, October 14 to 17, 1947.

In 1741 Andry, of the Faculty of Medicine of Paris, published a two-volume book in the preface of which he stated that "I have formed from the two Greek words, *Orthos,* which means straight, free from deformity, conforming to rectitude, and *Paidion,* meaning child, the word d'Orthopedie to express in one term the subject by which I propose to teach the various means of preventing and correcting in children the deformities of the body." At its very inception, therefore, the word *orthopedics* was coined to mean, as the subtitle of Andry's book states, "the art of preventing and correcting deformity." Since then the word has been adopted by that branch of surgery which is particularly interested in the mechanical framework of the human body together with the knowledge of the function and structure of the body which that implies. This specialty has expanded so in the last fifty years that it now overlaps most of the various fields of medicine. The name is not entirely appropriate, but the prevention of deformity is still one of the basic principles on which orthopedic thought must always rest.

It is for this reason that we who have chosen orthopedics for our special field are vitally interested in the treatment of infantile paralysis from the very onset of the disease and not only

in the residual stages where flaccid paralysis is present and where deformity may already have developed. The diagnosis and the general treatment in the acute phase of the disease fall largely in the province of the family physician, the pediatrician, or the neurologist, and are not subjects for full discussion here, but the brilliant work which has been done with tracheotomy and oxygen therapy on bulbar cases in recent epidemics and which has saved many lives must be mentioned. It is one of the spectacular advances in the treatment of acute poliomyelitis. The orthopedist must be willing to work closely with all attending physicians and be prepared to aid and advise them and accept at least some responsibility for the prevention of deformity and the preservation and reeducation of function.

KEITH has said that "a knowledge of muscles is the beginning and the end of all orthopedic treatment," but even if we feel that this is only partly true, we must admit that when dealing with infantile paralysis, this knowledge is indispensable. Unfortunately, there is as yet no united opinion as to the physiology of muscle contraction and even as to the action of certain muscles when they do contract, but this limitation of our information must not keep us from applying what we do know from a practical standpoint to our supervision of the cases coming under our care. Let us realize at once that there is something more to infantile paralysis than the residual flaccid paralyses and deformities which have always been assigned to the orthopedist. We must find out how these problems can be simplified by having them before us from the very onset of the disease.

A summary, in the early 1930's at one of the hospitals for crippled children with which I was connected, showed that during the ten-year period immediately preceding that time 37 per cent of the admissions had been for residual poliomyelitis and that a high percentage of these children had deformities of some type or other, many very severe, at the time of entrance. The hospital did not take acute cases, which was true of most children's orthopedic hospitals, and therefore, the only picture of the disease which one gained at that time in such an institution was that of residual paralysis and deformity. If an orthopedist was called in during the acute stage of the infection, the treatment recommended and used was based on the classical teaching of enforcing complete rest of paralyzed muscles and preventing deformity by means of splints, frames, plaster of Paris dressings, etc., and these principles were carried on into the convalescent stage. As a result of more modern treatment, the percentage of cases in need of late orthopedic care has apparently greatly decreased.

In every epidemic a high percentage of all cases recover either completely or with very little disability, but the criterion of recovery has not been the same in all reported series. The fact that all the muscles in any particular case appear to be contracting normally does not necessarily mean that 100 per cent recovery is present, as it is also essential that all of the joints be capable of a full range of motion if that muscular action is to be completely efficient.

Residual stiffness is present in many cases who have apparently completely recovered, and this condition may lead to the development of late deformities unless it is recognized early. This stiffness is seen more often in the back than elsewhere, and it is these stiffened spines with no apparent paralysis of muscle which probably develop the curvatures that appear so unexpectedly during the first few years following an acute attack of infantile paralysis. Some so-called abortive cases undoubtedly contribute to this class, and it is possible that many of the group of scoliotics diagnosed as "idiopathic" are fundamentally unrecognized cases of nonparalytic poliomyelitis. In spite of all this, however, it is certainly true that a high percentage of individuals who have had clinical poliomyelitis completely recover, this percentage varying from epidemic to epidemic and depending very definitely, I believe, on the treatment received in the early stages.

At the other end of the list of those cases who survive are those individuals who form

the smallest group in any epidemic or series, probably rarely more than 2 per cent, and they are the ones who are completely disabled by a widespread residual flaccid paralysis. When every known procedure has been tried in these patients and all methods of treatment exhausted, the apparent uselessness of further therapy directed at the restoration of muscle power must be recognized and total disability due to irreversible paralysis accepted. Miracles do not happen to muscles after all the anterior horn cells which supply them with motor stimuli have been wiped out by the infection of poliomyelitis.

These severe cases must be nursed and cared for the rest of their lives, and this involves the economic and social factors in the individual case as well as the purely medical aspects. Supports for the body to allow easier sitting, special chairs in which the patient can be fastened, tables and rests for books and papers, special arm and hand rests, or splints which may prevent a flicker of power in a hand from being wasted, beds designed to make nursing easier, etc.; all these and many other similar appliances can be worked out by the attending physician and the orthopedist with the family and will go far in making life easier and more bearable to the individual who otherwise might be completely bedridden.

Between the two classes of patients just mentioned is another residual group, comprising probably up to 20 per cent of the individuals involved in any epidemic, in which one finds a certain amount of permanent flaccid paralysis or weakness. These are the cases which fall almost entirely into the field of orthopedics. The character of this group from the medical standpoint varies definitely with the type and thoroughness of treatment used in the earlier stages of the disease.

Deformity of some grade was the rule rather than the exception in the cases coming into our orthopedic hospitals up to fairly recent times, as already stated, and in one of our hospitals where a study was made, slightly over 50 per cent of the cases of infantile paralysis admitted in 1931 had scoliosis. The earliest that any of these cases was seen was six weeks after the onset of the disease, and most of them had been treated by accepted methods. The other deformities present included shortening of the calf structures with a fixed equinus position of the foot, clubfoot, permanent flexion of the knees, flexion and abduction of the hips, etc. Stiffness of the back was common, and shortening of the hamstrings was found in many cases. Our work was first to correct the deformities and overcome the shortening present in some of the muscles and to start muscle training in an endeavor to get the apparently involved muscles to contract or become stronger. Later mechanical and operative treatment entered the field, as it does at present.

At this point I would like to discuss very briefly why the cases which have been seen the last few years, including those from the recent epidemic of nearly 3,000 cases in Minnesota, seem to me to be in better condition when released from isolation than ever before. It has been stated that no treatment in the acute stages directed toward the muscles is of any avail and that neglected or untreated cases are just as good in the end, if not better than those receiving treatment by rest and splinting, but I cannot agree that this neglect is justified after reviewing the results of the Kenny method as carried on in Minnesota. Certainly deformities have been kept to a minimum, during the acute stage the patients have been more comfortable and the mental outlook definitely brighter, and the efficiency of the remaining muscle power has been developed and utilized to a maximum. Of course, if anterior horn cells are destroyed, they do not regenerate, and the amount of true flaccid paralysis due to this destruction is not influenced by any treatment known at the present time.

Our efforts at therapy must be directed then toward those other factors which are so prominent in the disease and which were definitely neglected or unrecognized by many of us earlier. This is no place to discuss the Kenny concept or to go into detail about the technic for

applying the ideas which make up that concept, but a very brief outline of the theory we accept and the treatment which we supervise and carry on in an effort to prevent stiffness and deformity, to overcome discomfort and pain and "spasm" of muscle, and to improve the physiology of muscles and reeducate them to resume activity is certainly in order.

"Spasm," or muscle shortening, or lack of extensibility, is present in almost every case in the acute stage, the neck, back, calf, and hamstrings being most commonly involved. This is accompanied by muscle soreness and probably is responsible for much of the pain complained of by the patient. Whether this spasm is due to direct involvement of the muscles by the disease, to neurogenic factors, or to some other mechanism is immaterial to this specific discussion, but unless it is overcome, fibrosis or permanent shortening may develop in the involved muscles, and deformity or the potential for deformity is present. It is possible that this latter condition accounts for the late development of scoliosis, as mentioned earlier.

TO DATE, the best method for relieving "spasm," or muscle shortening, is the use of very hot packs, as advocated by Miss Kenny. These are applied to the involved areas at various intervals, depending on the severity of the case, and undoubtedly act by stimulating a reflex action, as the intermittent heat with cooling seems to be far superior to continuous heat for this purpose. Packing a case properly is both hard physical work and time-consuming, and if something can be found to simplify this part of the treatment of infantile paralysis, it will be a great boon to those directly in charge of the cases. Much research is being carried on in an endeavor to find these simpler means, but as yet without any accepted success.

Several drugs have been used for the purpose of relieving muscle spasm, but the results do not seem to justify their general use or recommendation.

Prostigmine has been found useful by some observers, but it does not seem to be the answer to the muscle shortening in infantile paralysis and cannot be recommended for routine use.

Curare, which relaxes normal muscles, has been advocated during the last few years, but also does not appear to meet the requirements for relief of "spasm" in a poliomyelitic muscle where some local condition seems present which is not always affected by the drug.

It has been reported that sympathetic blocks will relieve the pain, tenderness, and "spasm" in some acute cases of poliomyelitis, and this procedure may be a useful adjunct under certain circumstances. I have had no personal experience with it.

All cases of infantile paralysis from the acute stage to the time of discharge should be given beds which are firm and hard (ours have no springs) and which are fitted with a foot board which serves to keep the pressure of the bed clothing from the feet and allows proprioceptive reflexes to be stimulated when the feet rest against it. It is not a splint in any sense, and if the calves are in spasm, no attempt is made to place the feet against it until this has been overcome. Space is provided between board and mattress to accommodate the heels or the toes, depending upon whether the patient is lying supine or prone in bed. The knees are supported in a slightly relaxed position with the arms placed alongside the body but not against it and in the externally rotated position.

Passive motion and possibly some stretching are started early as the pain subsides and are carried out through the gradually increasing painless range until full motion is obtained in all joints. Active muscle training of a meticulous kind is begun during this time, with emphasis on coordinated movement and never on strength. Even if muscle power is apparently absent, joint motion is worked for, as there is no foundation for the fear of damaging a muscle by early motion through its full range, and this early mobilization certainly favors neuromuscular regeneration. The proprioceptive stimuli are brought out, and the active motion re-establishes the motor pattern in the brain.

Standing and walking, very carefully supervised, are insisted upon early, usually as soon

as the calves allow the feet to come to a right angle, and in this way the loss of proprioceptive reflexes is kept to a minimum, and the kinesthetic sense of the upright position is not lost. The so-called Canadian crutches are used where possible and no incoordination allowed to develop at any time.

WHERE ideal treatment has been carried out from the onset of the disease, starting with the proper positioning of the patient in bed and working through the various procedures very briefly outlined above, the end result will tend to be an individual with minimal or no deformity, with no contractures, with passively freely movable joints, and with the ultimate in coordinated function which is possible with the muscles left to that individual. Unfortunately, all cases do not receive or respond to this ideal treatment from the start and have developed stiffness and contractures when first seen, but the same general methods should be applied with the knowledge that full range of motion, especially in the back, may never be obtained.

No harm seems to be done by stretching any tightened structure, well within the limit of the patient's endurance, so as to eliminate tearing of muscle fibers during the course of treatment, but after all traces of "spasm" have disappeared. Fibrosed muscles will frequently elongate considerably with this daily stretching, and patients soon learn how to help in accomplishing this end by their own efforts. More radical treatment is sometimes necessary to overcome shortening, however, and manipulations under anesthesia and operations on fasciae and aponeuroses must be done before all contractures are eliminated. It is only when deformity is absent that the best can be obtained from reeducation and physical therapy.

During the last few years the procedure known as neurotripsy has been developed by Doctor Billig and his associates, and it is thought by some that this operation may become a routine one in the treatment of late cases of infantile paralysis where there is residual paralysis and the return of power is at a standstill. The principle behind this method is based on the fact that if a motor nerve fiber is torn or crushed, it will tend to heal by arborization, or by sending out several branches instead of the original single fiber. These branches theoretically seek out muscle cells and, therefore, in the end increase the active nerve supply to the muscles with the result that power is increased also and the clinical picture definitely improved. As now performed, the muscles are strongly kneaded by a blunt instrument similar to an electric hand drill on the supposition that the fibers will be forcibly separated and intramuscular nerve fibers torn enough to start the arborization mentioned above. Fibrocystic areas in the muscles are, of course, broken up at the same time. Practically, there have now been enough cases with clinical improvement following this treatment to make its use a definite addition to our therapy.

When all of the indicated procedures discussed here have been faithfully followed, the number of mechanical appliances or braces needed in any specific group is reduced to a minimum, and the indications for orthopedic operations become much fewer than formerly.

There will always be a small residual group of cases (small compared to the total number in any epidemic) who will in the end require some operative treatment to lessen their functional disability due to flaccid paralysis, regardless of the excellence of the early therapy. The procedures to be used in this group are almost innumerable, and the specific nature of the operations is a purely orthopedic problem.

When the end result in any case can be accepted as probably final, the individual must be helped as much as possible to resume a normal life within the limits of the remaining disability and should have all emphasis removed from the fact that he is or has been a cripple. Patients usually experience a rather severe psychologic reaction when confronted with the diagnosis of infantile paralysis, and the emotional symptoms must be carefully neutralized if they appear. Formal psychiatric treatment is rarely needed, however.

# Tumors of the Brain

## ADVANCES IN DIAGNOSIS AND TREATMENT

WINCHELL McK. CRAIG*

MAYO CLINIC, ROCHESTER, MINNESOTA

Tumors of the brain producing symptoms which are progressive present a challenge to the entire medical profession. Neurologic surgery has advanced through the cooperation of the general practitioner, internist, pediatrician, neurologist, ophthalmologist, radiologist, and every other physician who is called upon to treat symptoms of disturbances of the central nervous system. With the advancement of the technic of neurosurgery has come the realization that early diagnosis is important, and early recognition of symptoms is necessary if successful surgical intervention is to be accomplished.

During the war, although the great interest centered around cerebral trauma, neurologic diagnosis and neurophysiology received great impetus through research projects which were a part of the war effort. Now that our interest has returned primarily to intracranial neoplasms, it is interesting to note that the contributions to our knowledge of neurophysiology, as well as general physiology, antibiotic therapy, and preoperative and postoperative care, have enlarged the sphere of neurosurgery and consequently are reflected in the diagnosis and treatment of tumors of the brain.

*Section on Neurosurgery, Mayo Clinic, Rochester.

Presented before the meeting of the Interstate Postgraduate Medical Association of North America, St. Louis, Missouri, October 14 to 17, 1947.

It has been demonstrated that if intracranial lesions are to be diagnosed earlier, physicians must be on the alert for symptoms, and in view of the fact that adult patients usually consult their family physicians and that younger patients are taken to pediatricians, these and all other consultants should maintain a suspicious attitude toward the lesions in question.

The three cardinal symptoms of tumor of the brain are headache, nausea associated with a projectile type of vomiting, and visual loss. There are many other symptoms which it would be well to mention, such as unsteadiness of gait, dizziness, unilateral deafness, roaring noises in the ear, gradual progressive paralysis, especially of one side of the face or body, unexplained partial loss of vision, causing the patient to bump into doors and other people, and unexplained convulsive disturbances which develop after adolescence.

Similar to what happens in other clinical entities which have cardinal symptoms designated as "pathognomonic," if we wait for the development of the three cardinal symptoms assigned to brain tumor, the disease is more than likely to be far advanced and therefore to be accompanied by a greater mortality rate and a lessened chance of restoring function.

The history of the patient is a very impor-

tant and significant factor in the diagnosis, for rather frequently some episode which may seem unimportant to the patient or the relatives holds the clue to the diagnosis. Of equal importance is the general physical examination, for intracranial lesions may be associated with systemic disturbances and primary malignant lesions situated elsewhere.

Roentgenologic examination of the head, thorax, and spinal column is essential. Camp[1] and other radiologists have stressed the importance of a very careful roentgenologic examination of the head. Camp called attention to the fact that there are certain important roentgenologic signs of intracranial disease and he grouped them as follows: (1) calcification within the lesion itself, (2) localized changes in the bone, such as destruction, proliferation, or both, (3) changes in the sella turcica, (4) changes in the bone resulting from increased intracranial pressure, (5) displacement of the pineal shadow, (6) air in or about the lesion, and (7) increased vascularity of the bone.

Calcification within the lesion itself is present in only a small percentage of abnormal conditions. Such structures as the pineal body, the pacchionian bodies, and the choroid plexus normally may exhibit a certain amount of calcification. Areas in the falx or the tentorium frequently described as "calcification" probably should more properly be considered as ossification. Lesions that may exhibit areas of calcification include tumors, hematomas, tubercles, cysts, old abscesses, areas of old meningeal lesions, encephalitis, carotid arteries, and aneurysms (Figure 1). Calcification occurs in about 12 per cent of gliomas and in 70 per cent of suprasellar cysts. Cerebral aneurysms may evidence themselves by calcification in the walls.

The bones of the skull overlying a contiguous tumor may exhibit locally the change of destruction or proliferation or both. Local changes in the bone which accompany many meningiomas are rather characteristic, and consist of erosion, increased vascularity, formation of an osteoma, both localized and diffuse, enlargement of the vascular channels, and calcification.

WINCHELL McK. CRAIG

Roentgenologic changes in the sella turcica indicate any lesion within the sella or in continuity. The lesions producing deformities of the sella turcica, according to Camp, may be classified as (1) intrasellar tumors involving the pituitary gland, (2) suprasellar lesions producing localized erosion of the sella turcica, and (3) disease of the sphenoid bone or primary conditions, both benign and malignant. Any change in the sella turcica should be suggestive of disease of the sphenoid bone, in view of the fact that changes secondary to malignant tumor extending from the nasopharynx and involving the sphenoid process are very common. In these conditions the sphenoid sinus is increased in density, and there is a haziness of the floor of the sella turcica.

In many roentgenograms of the head the pineal body is calcified, and displacement of this shadow is evidence of a space-occupying lesion. The presence of this calcified change in the pineal body is valuable in diagnosis, in that it may save the patient an encephalogram or

ventriculogram in localization of the tumor. It is well to remember that in the lateral view an area of calcification of the choroid plexus may simulate in position and shape a calcified pineal body.

In the diagnosis of tumors of the brain, the most important examination probably is a complete and comprehensive neurologic examination in which any changes in reflexes, motor and sensory abnormalities, and any deviation from the normal in posture, gait, state of equilibrium, and mental acuity are noted.

The three cardinal symptoms already referred to are produced by increased intracranial pressure, caused either by tumor of the brain or by inflammatory lesions such as arachnoiditis or abscess. Vascular lesions, such as aneurysms or intradural or extradural hematomas, may cause the same type of symptoms.

HEADACHE is the first and most common of these symptoms, although many tumors of the brain attain considerable size without producing it. More than half of the headaches resulting from increased intracranial pressure are not localized to a definite region or even to one side of the head, but are diffuse. Generalized headache caused by intracranial pressure is described as "deep and expanding"; seldom is it continuous; it occurs intermittently, usually in the morning, or every two or three days, and may be relieved by vomiting. Headache of psychogenic origin usually is more superficial, more extensive, more nearly constant and unremitting than that caused by intracranial pressure. It may be stabbing or boring, and confined to the top of the head or occipital region, producing a sense of tightness of the occipital muscles. Migraine headache may be general or confined to half of the head; it is experienced in attacks which last from half a day to four days, and is associated with nausea, vomiting and, sometimes, visual disturbances such as hemianopsia or scotomas.

The second cardinal symptom, vomiting associated with tumor of the brain, usually occurs at the peak of the headache and is followed by relief of the headache; it may or may not be associated with nausea, but it is not related to the eating of food. An explosive or projectile type of vomiting, although it is not essential, is suggestive of intracranial pressure. The relief of headache by vomiting is much more suggestive of tumor of the brain than is the character of the vomiting.

The third cardinal symptom has to do with the eyes. It may be indicated by loss of visual acuity or contraction of the field of vision. The interpretation of papilledema and changes in the perimetric fields in terms of intracranial changes has aided in early diagnosis (Figures 2*a* and *b*). Examination of the eye grounds is necessary for determination of the presence of papilledema or choked optic disk. It has been said that an ophthalmoscope is of more importance in the diagnosis of lesions of the brain than is the stethoscope in the diagnosis of lesions of the thorax.

Papilledema may be due to either increased intracranial pressure or optic neuritis. Papilledema may be present in cases of hypertension, acute and chronic nephritis, multiple sclerosis, endocarditis, diabetes, myopia, and hyperopia. Examination of the ocular fundi with the ophthalmoscope is important in determination of the presence or absence of hemangiomas of the fundi. If such lesions are found, they are almost pathognomonic of hemangiomas of the brain, usually situated in the cerebellum. A careful perimetric examination of the visual fields should be done, for early changes may indicate the site of the lesion.

Convulsions may indicate increased intracranial pressure or localization of the lesion. Tonic convulsions seem to arise from a lower level in the brain than that from which the clonic type arises. Whenever the convulsions involve one side of the face, or an arm or leg, they are of localizing value and indicate a lesion involving the contralateral motor area. Convulsive seizures occurring after adolescence which are not due to a toxic condition or constitutional disturbance should be looked upon as suggestive of tumor of the brain. Penfield and co-authors,[2] in a review of a series of cases,

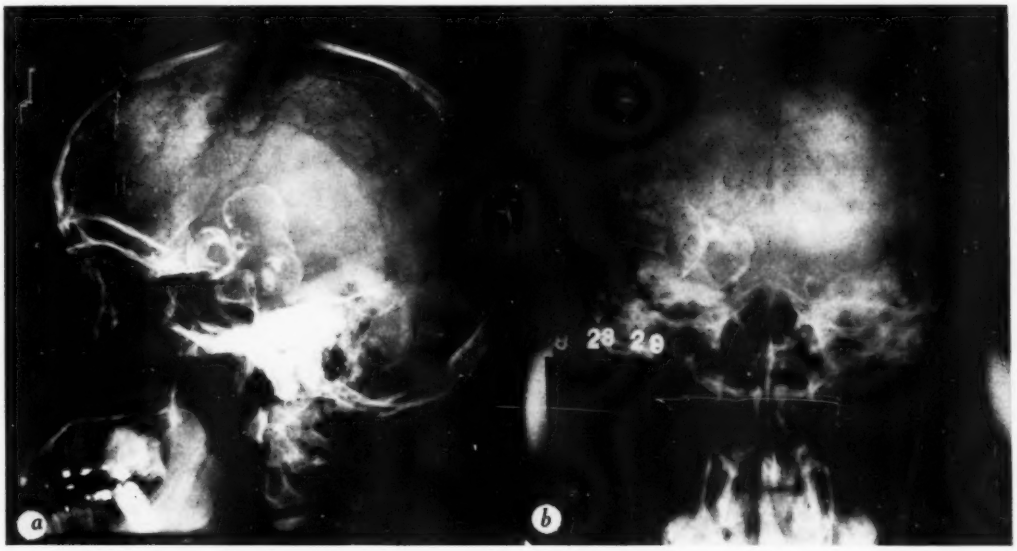

Figure 1*a*. Lateral view, and *b*, anteroposterior view, of a large calcified intracerebral aneurysm in a patient who had a history of generalized convulsions for thirteen or fourteen years, and constant headache and blurring of vision for ten years (reproduced, with permission of the publisher, from: Bancroft, F. W., and Pilcher, Cobb, eds.: Surgical Treatment of the Nervous System. Philadelphia, J. B. Lippincott Co., 1946).

found that when convulsive seizures were caused by tumors of the brain, they occurred in 37 per cent of glioblastomas, 70 per cent of astrocytomas, 68 per cent of meningiomas, 18 per cent of hematomas, and 50 per cent of abscesses which were checked.

It is sometimes very difficult to recognize the early symptoms of tumors of the brain in children, in view of the fact that children often complain of headache, nausea, and vomiting. Although it is true that many tumors in children are very malignant and only palliative operation can be carried out, the more benign tumors can be removed successfully quite often.

Recently a series of about 600 tumors occurring in children who had been operated upon at the Mayo Clinic was reviewed by Keith, Kernohan, and me.[3] In 490 of these, the type of lesion present was confirmed by the pathologist on the basis of study of tissue removed at operation. Surprisingly enough, it was found that instead of the malignant medulloblastoma, the more benign astrocytoma predominated. The cases were divided according to the type of tumor present and the length of survival of the patient after operation. Although the immediate mortality rate was rather high in the early days of the series, with the advancement of knowledge of symptoms of tumors of the brain in children, patients began to be sent to the neurologic surgeon earlier in the development of their disease. It was apparent that the early diagnosis of tumors of the brain in children allowed earlier operation, and as the years progressed not only was the mortality rate lowered but the number of one-to-five year survivals was greater. Thus, the conclusion drawn from this study was that the early diagnosis of tumors of the brain in children is associated with a greater percentage of operability, lessened morbidity and mortality rates, and a greater life expectancy.

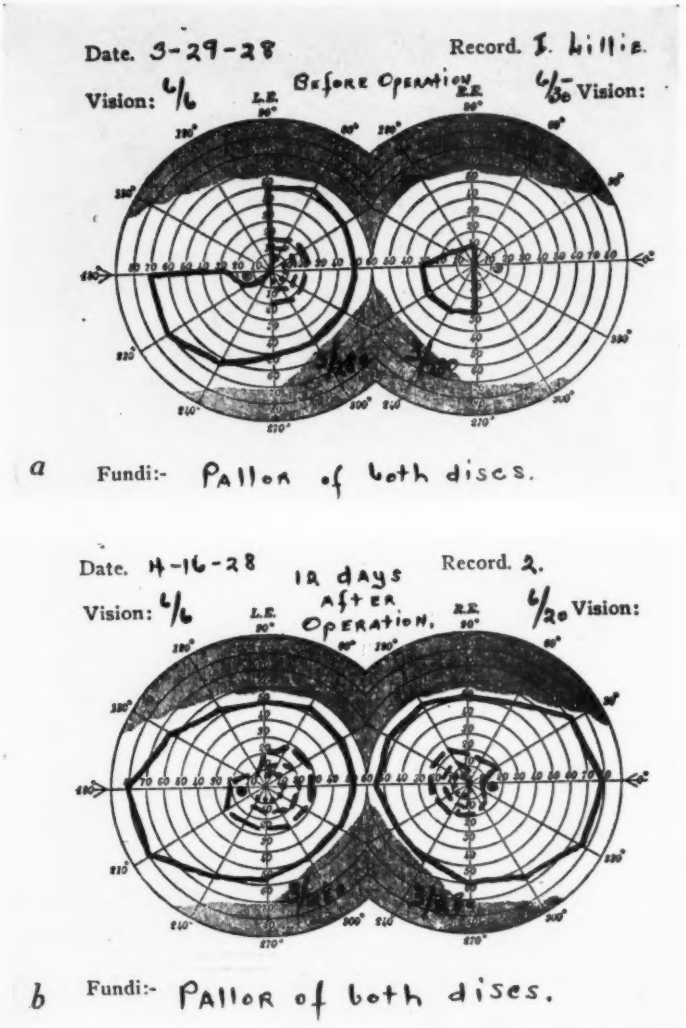


Figure 2*a*. Perimetric fields, charted preoperatively, of a patient whose optic disks exhibited marked pallor; *b*, remarkable change in the fields of the same patient, twelve days after operation. Twelve years after operation, the fields and fundi were normal and the patient was in excellent health (reproduced, with permission of the publisher, from: Bancroft, F. W., and Pilcher, Cobb, eds.: Surgical Treatment of the Nervous System. Philadelphia, J. B. Lippincott Co., 1946).

TUMORS of the brain most difficult to diagnose and operate on in the early stages of development probably are the meningiomas or the benign fibroblastic neoplasms sometimes called "endotheliomas." Occurring frequently in the so-called silent areas of the brain, they may masquerade as epilepsy, diffuse headache, or change in personality. Ventriculography is required to establish a diagnosis. When these lesions occur in the areas which subserve definite functions, they localize themselves early and, therefore, are amenable to more successful surgical treatment.

There are tumors within the intracranial cavity the early symptoms of which are not due to increased intracranial pressure but are due to pressure on certain cranial nerves or isolated areas of the brain. In this group are tumors of

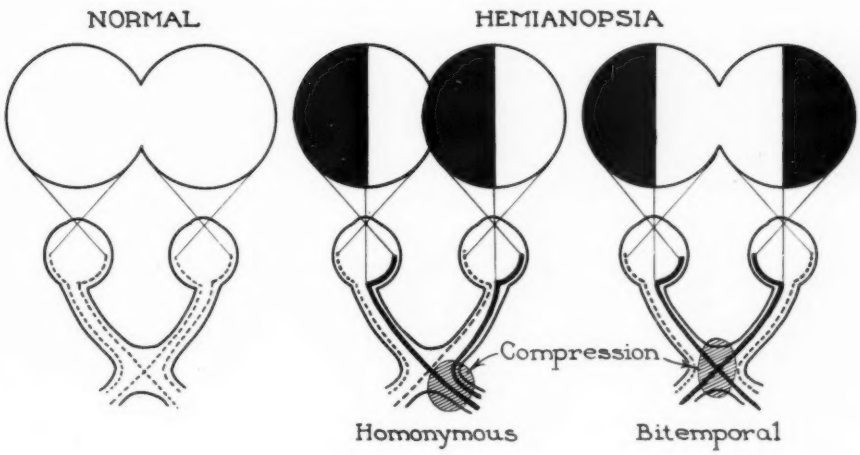


Figure 3. Schematic representation of the production of homonymous hemianopsia and bitemporal hemianopsia by lesions situated about the optic chiasm (reproduced, with permission of the publisher, from: Bancroft, F. W., and Pilcher, Cobb, eds.: Surgical Treatment of the Nervous System. Philadelphia, J. B. Lippincott Co., 1946).

the hypophysis and other lesions about the optic chiasm and tumors which occur in the cerebellopontine angle.

Pituitary tumors produce symptoms which involve the vision and the endocrine system. Sometimes the first indication of pituitary tumors in women is amenorrhea which is due to endocrine dysfunction. Patients suffering from pituitary tumors or tumors about the optic chiasm may complain of visual difficulties, and may undergo repeated examinations of the eyes before the lesions are recognized (Figure 3). Frequently their glasses are changed until the vision is almost lost and the optic nerves are irreparably damaged before a diagnosis is made. Then, of course, removal of the pituitary adenoma does not restore normal vision because of the development of optic atrophy. Probably in no other group of tumors of the brain is an early diagnosis so important, because if the lesion is recognized early and operation is carried out, the mortality rate is very low, the chances for recovery are better and restoration of the normal endocrine function is possible.

WHAT probably was the earliest diagnosis of tumor of pituitary gland at the Mayo Clinic was not made by a neurologist or an ophthalmologist or a neurosurgeon, but by an obstetrician. The patient came for a consultation for sterility, and when the obstetrician called attention to the amenorrhea and suggested the diagnosis, he asked for a roentgenogram of the skull. This was made. It revealed an enlarged sella turcica. Perimetric examination of the visual fields then was done; this revealed bitemporal hemianopsia which had been unnoticed by the patient until it was called to her attention. Operation was carried out in this case; the normal menses recurred, and a normal pregnancy was completed.

Tumors of the cerebellopontine angle are, in the majority of cases, benign neurofibromas which arise from the eighth cranial nerve. Meningiomas also may arise in the cerebellopontine angle, creating a series of symptoms which are difficult to distinguish from those of neurofibromas. If these tumors are not recognized early, they may grow to a considerable size, compress the cerebellum, and produce

ataxia and incoordination. By increasing the pressure within the cranial cavity, they may also produce papilledema. The neighboring cranial nerves frequently are involved when such tumors are advanced, and facial palsy sometimes develops from involvement of the seventh cranial nerve and numbness of the face and cornea develop from pressure on the fifth cranial nerve. When these tumors are recognized and operation is performed early, they can be removed with relatively little danger and, although the hearing cannot be restored, the other symptoms can be relieved. It is when the tumor has advanced and become large and produced signs of increased pressure that the mortality rate is high and the postoperative results are unsatisfactory.

Thus, it is apparent that tumors of the brain which are diagnosed early in their development are amenable to surgical treatment. This applies not only to the benign, encapsulated tumors, but also to the infiltrating malignant gliomas. However, in the early development of tumors of the brain the symptoms sometimes are so vague and uncertain that arrival at a definite diagnosis is impossible. In this event one of two courses is open, from the diagnostic standpoint. First, a patient can be kept under observation until more definite symptoms have developed or, second, encephalography or ventriculography can be carried out. Probably the greatest contribution to the early diagnosis of tumors of the brain is the injection of air within the intracranial cavity by the lumbar or ventricular routes. This procedure should be carried out only after a very careful general, ophthalmologic, roentgenologic, and neurologic examination, and never should be considered without full realization of the risk incurred.

ENCEPHALOGRAPHY, or the removal of cerebrospinal fluid and the injection of air through the lumbar route, never should be undertaken in the presence of increased intracranial pressure as evidenced by choked optic disks or papilledema. Much emphasis has been laid on the danger of performance of lumbar puncture in the presence of increased intracranial pressure. It is even more hazardous to attempt removal of fluid from the subarachnoid space and to replace it with air.

When increased intracranial pressure is present, ventriculography, or the removal of cerebrospinal fluid and replacement of it by air from the lateral ventricles, is the operation of choice. It, also, is accompanied by a certain hazard, but this hazard is minimized when craniotomy is performed immediately afterward. Roentgenograms made after the injection of air through either the lumbar or the ventricular route furnish much information with regard to intracranial contents. A normal distribution of air in the subarachnoid space, in and around the convolutions of the cortex and within the ventricles rules out the possibility of an intracranial tumor.

Several years ago Grant[4] reported 392 cases of ventriculography collected from members of the Society of Neurological Surgeons. Positive information as to the localization of the tumor was obtained in approximately 80 per cent of the cases. In 30 per cent definite facts as to the situation of the neoplasm were given when all other evidence was absent, and nearly 80 per cent of the tumors localized by ventriculography in the absence of neurologic evidence could be removed surgically.

One of the advances in the diagnosis of intracranial lesions has been the so-called electroencephalogram. Electro-encephalography, a technic whereby the electrical activity of the human cerebral cortex is recorded through the intact scalp, has been in use for many years. Berger[5] was the first to show, in 1929, that the electrical activity of the human brain could be detected from outside the skull. He called the record of this activity obtained with the galvanometer or amplifier and oscillograph the "Elektrenkephalogram."

The most prominent feature of an electroencephalogram of the normal human brain is what Berger called "alpha waves." These have amplitudes between 10 and 100 microvolts, and a frequency of about 10 cycles per second.

Berger also described the beta waves. These are not seen so regularly as are the alpha waves, and their origin and significance are doubtful. They appear in the frontal lobes of some subjects. The gamma waves are seldom seen, are of small size and high frequency. Berger wrote: "In cases of intracranial tumor in which the cerebral cortex is affected by invasion or proximity and where the pressure has been reduced or is still moderate, slow potential waves (10 to 20 microvolts in size, and occurring at the rate of 2 to 3 per second) have been led off from the skull over the place where the tumor was subsequently found."

ELECTRO-ENCEPHALOGRAPHIC records obtained through electrodes applied to the scalp record minute electrical potentials arising from the cortical tissue close to the electrode. These potentials vary in amplitude from 2 to 300 millionths of a volt, and in frequency from 1 up to 50 per second. These electrical potentials are thought to originate in the individual neurons, and the recorded activity to represent the synchronous beat of masses of cells discharging rhythmically and in unison. The character of the electrical activity at any one time may then be expected to be determined by the spontaneous activity of the individual neuron and by the efficiency of the synchronizing process. The individual neuron is in a state of continuous spontaneous activity, and even when presumably at rest it is rhythmically building up and discharging electrical energy. The energy for this process arises from the intrinsic metabolic activity of the cell. Within certain limits, increased metabolic activity may be expected to increase the frequency, and reduced metabolic activity to decrease the frequency. Changes in the rate, form, and, within limits, the amplitude may be interpreted, in part, in terms of the individual neuron beat.

For all practical purposes, it may be stated that certain electrical impulses are given off through electrodes from the human cortex which are transmitted to a recording apparatus which reveals certain synchronicity of the impulses under normal conditions, and that any variation in the normal impulses indicates some pathologic condition.

Normal electro-encephalograms range from very rhythmic, regular, and well-synchronized records with frequencies from 8 to 12 per second to irregular, poorly synchronized records in which frequencies are not well defined, but may include faster and slower frequencies which are of low voltage. However, it has been found that under comparable conditions an electro-encephalogram of the cortex of the same person remains remarkably constant from day to day and even from year to year. There is an overall characterization, which cannot be defined adequately in terms of any such property as frequency or amplitude, that has been compared by some to the constancy of facial features, and that may be almost of identifying value for individuals.

The so-called adult norm is not reached until a person is around 13 years of age. Before this age, and, in some apparently normal children, after this age, the electro-encephalogram shows varying amounts of slow activity. This slow activity gradually diminishes and usually has disappeared by the age of 13 years. Once the adult pattern has been attained, it seems to remain remarkably constant. The only essential difference related to sex is the fact that female children seem to have a slightly faster pattern than do male children of the same age.

During the recording of the electro-encephalogram, changes in attention seem to affect chiefly the synchronizing mechanism. Thus, with the patient's eyes open, normal synchrony is disrupted by visual impulses leading to decreased regularity and the development of a low-voltage, fast pattern characteristic of a loss of synchrony.

The reduction of oxygen tension and blood sugar affects the cerebral metabolic rate, since the brain tissue, for practical purposes, may be considered to be dependent on adequate supplies of oxygen and glucose for normal metabolic activity.

It is well known that drugs affect the normal electro-encephalogram. Drugs are either

cerebral stimulants such as caffeine, benzedrine, epinephrine, strychnine, and camphor, or are cerebral depressants, such as the barbiturates, paraldehyde, chloral hydrate, ether, alcohol, and bromides. In general, the stimulants lead to increase in frequency and the depressants to decrease in frequency.

According to Reese and Masten,[6] an abnormal electro-encephalogram in epilepsy only reproduces graphically neuronal electric potentials which, paroxysmally reaching a certain threshold, may eventuate in various clinical types of seizures, each type corresponding to certain brain-wave formations. These authors quoted the Gibbses[7] as stating that the various types of seizures are manifested by waves either slower than the normal 10 per second frequency or faster, 25 to 30 per second spikes of grand mal seizure. Jasper and Kershman[8] questioned whether the type of clinical seizure can be forecast accurately from electro-encephalograms, whereas others assume that it can. A normal electro-encephalogram does not exclude epilepsy; 5 to 15 per cent of epileptic persons have normal records. An abnormal electro-encephalogram should not lead to a diagnosis of epilepsy without history and clinical evidence.

Important from the standpoint of this discussion is the electro-encephalographic localization of cerebral tumors. Reese and Masten wrote that cerebral localization of tumors of the brain by electro-encephalography is a diagnostic aid, but cannot replace entirely such procedures as angiography, encephalography, and ventriculography. Although tumors of the brain are electrically inert, the focal slow delta waves point to a regional cortical pathologic process. The electro-encephalogram is not an indicator of the number of active brain cells, and the absence of large numbers of neurons is not detectable by this electronic method.

Electro-encephalography has been investigated not only as a diagnostic aid in localizing tumors of the brain but also as an indicator as to the pathologic nature of the tumor involved. Williams and Gibbs[9] wrote that by correlating the frequency and amplitude of pathologic waves with position and extent of the discharge, it was sometimes possible to surmise the nature of the lesion. Greenstein and Strauss[10] reported 47 cases of gliomas and 8 cases of metastatic carcinoma. In 74 per cent of the spongioblastic tumors the focal per cent time delta was 40 or more. In 10 per cent of the transitional and in none of the well-differentiated gliomas was it 40 or more. These results seem to indicate that a focal per cent time delta of 40 or more is strongly indicative of spongioblastic or metastatic carcinomatous tumors. Reese and Masten wrote, further, that there is a definite correlation between the rapidity of growth and the percentage time wave deltas of the abnormal electro-encephalogram.

In view of the fact that I have been emphasizing the importance of early diagnosis of brain tumor to allow earlier operation, another diagnostic test which permits distinction between vascular and neoplastic lesions should be mentioned. This examination is cerebral angiography. Cerebral angiography was started by Moniz[11] in 1927. He was a neurologist in Lisbon, and there began his experiments in cerebral angiography. Since that time countless mediums have been used in visualization of the cerebrovascular tree by the injection of various agents into the carotid and vertebral arteries. Moniz first used potassium bromide and then sodium iodide, both of which caused serious reactions. In 1931 he used thorotrast, a material which produced roentgenograms of excellent diagnostic quality and caused little or no immediate reaction. It was found, however, that thorotrast had a high and lasting radioactivity, together with almost quantitative storage in the reticulo-endothelial system. Thorotrast is the trade name for a colloidal preparation of thorium dioxide.

Two types of damage to tissue have been shown to be caused by the radioactivity of thorium. For that reason, another medium was sought. The material finally found was called "perabrodil," and was used in Europe. It contains about 50 per cent of fixed iodine, is high-

ly soluble, and is stable in an aqueous solution. It is excreted quickly and is unchanged in the urine after it has been injected intravenously or subcutaneously. It is widely used for intravenous urograms and is called "diodrast" in the United States. Sensitivity to diodrast may develop in some persons. For this reason, preliminary ocular or intradermal tests of sensitivity should be made.

In the early tests with diodrast, 15 cc. of a 70 per cent solution was injected at one time. It was noticed that in some cases mild jacksonian convulsions occurred and that neurologic symptoms increased. For this reason, it was decided to use a less concentrated solution of diodrast. A 35 per cent solution was used for arteriograms without any evidence of adverse effect. It was found that in the lower concentration—35 to 50 per cent—diodrast is slightly less dense than thorotrast, and that it has the great theoretic advantage that the total amount injected can be much larger. By the repeated injection of small doses of a 35 per cent solution, satisfactory visualization can be obtained without the occurrence of untoward symptoms.

Ingraham and Cobb[12] reported on 25 patients ranging in age from 1 year and 10 months to 68 years who received two or more injections of 10 cc. of a 35 per cent solution of diodrast during the ensuing three years. In their summary, Ingraham and Cobb wrote: "Nineteen years have passed since Moniz introduced cerebral angiography, yet, because of its technical difficulty and its possible danger to patients this diagnostic method has not come into general use.

"Thorotrast has been the most widely employed contrast medium, although its dangers have been well known. Evidence is now beginning to appear in the literature that this material may cause sarcoma and other types of radiation damage in man as well as in experimental animals.

"Diodrast (perabrodil) is a suitable medium for cerebral angiography. It is inert in the body, quickly excreted, and highly soluble. When large quantities of a concentrated solution are used in angiography, reactions attributable to the hypertonicity of the solution may be encountered. To obviate the occurrence of reactions, a method of injecting small quantities of dilute solutions of diodrast with a special angiogram needle is presented. . . .

"Diodrast appears to be a safe contrast medium for cerebral angiography in both adults and children when used in this way. Roentgenograms of satisfactory quality are secured and several injections may be made for stereoscopic arteriograms, for anteroposterior projection, and for demonstration of two or more of the four arterial networks of the brain."

Thus, it is seen that in the diagnosis of tumors of the brain, in addition to (1) the usual general examination, (2) the neurologic examination, (3) roentgenographic examination of the skull, and (4) ventriculography by means of the injection of air into the ventricles and the subarachnoid space, two new diagnostic methods have been developed. These are (5) electro-encephalography, and (6) angiography. Both of these diagnostic procedures have not been satisfactorily carried to completion. It is recognized by everyone using them that they are of value, if they are employed in conjunction with the history and the complete examination, but as diagnostic entities they are not at present dependable, either in the making of a diagnosis or in the ruling out of an intracranial lesion.

FROM THE standpoint of diagnosis, no evidence is brought out by the history or examination which determines the nature of the intracranial lesion. It is only at operation, when tissue is removed for microscopic diagnosis, that a definite diagnosis can be made (Figures 4*a* and *b*). At one time it was thought that a short history with rapid progression of symptoms indicated a highly malignant and inoperable lesion, but time and again patients are seen who give a short history with rapid progression of symptoms who are suffering from benign, operable, and removable lesions. At present, from the standpoint of diagnosis, it is the consensus that every intracranial lesion of which the diagnosis

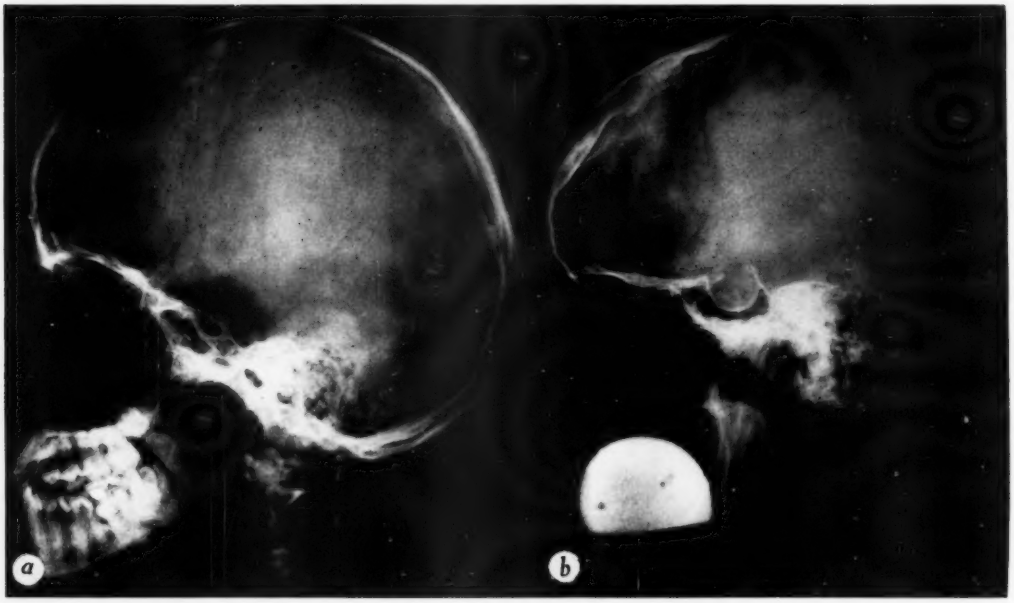


Figure 4*a*. A normal sella turcica associated with bitemporal hemianopsia; at operation a small suprasellar cystic tumor was removed; *b*, an enlarged sella turcica, with symmetric erosion caused by an intrasellar tumor of the pituitary body. (Reproduced, with permission of the publisher, from: Bancroft, F. W., and Pilcher, Cobb, eds.: Surgical Treatment of the Nervous System. Philadelphia, J. B. Lippincott Co., 1946.)

is doubtful should be operated upon as early as the diagnosis can be made and localization can be ascertained. Only in this way can the operable lesion be exposed, and if a malignant type of glioblastic tumor is encountered, as radical a removal as possible should be attempted.

Not only has the development of neurosurgery been associated with improved diagnostic methods, but certain improvements in technic have been developed which have contributed greatly to the lowering of the mortality rate and the securing of permanent cures in the treatment of tumors of the brain.

Two complications in the operative recovery after the total or subtotal removal of tumors of the brain have been hemorrhage and cerebral edema. One of the outstanding recent contributions to the technic of neurosurgery has been the development of newer methods of hemostasis. For years it had been the custom of surgeons to use autogenous muscle pledgets for the control of surface bleeding. One of the French surgeons used muscle from the breast of a dove removed under sterile conditions in the operating room. Thrombin, when applied topically, was found to have the same effect, but when it was sprayed on the surface of the brain or bleeding dura, it tended to be washed away by the seeping blood. Therefore, substances were sought for use as absorbable sponge material which could be soaked in thrombin. Three such substances were developed. A partially oxidized cellulose, which was prepared in the forms of gauze, cotton, and paper, was produced.

Although they were not the best carriers for thrombin, these substances were found to have valuable hemostatic properties in themselves, and they have been extremely useful, particularly where a small, tight pack is needed for the control of hemorrhage. Both experimental evi-

dence and clinical evidence point to the ready absorbability of this oxidized cellulose when it is used within the cranial cavity. A new processed oxidized cotton has been developed which may prove to be a more nearly ideal hemostatic agent.

During the war, when plasma was being processed, a by-product, fibrin foam, was discovered. This substance, when dried, proved to be a friable, porous material which absorbs thrombin readily, and which can be applied topically in the form of small pledgets. Fibrin foam can be left in place and it is not toxic. It seemed to be the logical hemostatic agent. But with the cessation of war and the decrease in the manufacture of plasma, it became difficult to process fibrin foam. For that reason, other substances were sought. It was found that gelatin can be processed into a foam-like sponge which can be rolled into various thicknesses, is tough enough to be cut into various sizes, and carries the thrombin as well as does fibrin foam. Thrombin, also a by-product of plasma fractionation, became difficult to obtain; bovine thrombin has been used in its place without any signs of toxicity. Thus, one of the newer developments of war medicine has been the production of hemostatic agents which have added greatly to the armamentarium of the neurosurgeon in the removal of intracranial tumors.

Cerebral edema, associated with the removal of intracranial lesions or the postoperative convalescence of the patient, has been a complication which has increased the mortality and the morbidity rates and has been a distressing factor in the convalescence of the patient. Hypertonic solutions have been used; dehydration has been used; but in almost every case there has been some reaction.

During the war a substitute for plasma was sought for use in the theaters of war. One of the by-products of plasma fractionation was serum globulin. It was found that in addition to being an adequate substitute for the use of plasma in shock, serum globulin is of great benefit in cerebral trauma as a dehydrating mechanism. At present, serum globulin as a dehydrating agent after injuries to the head and the removal of cerebral tumors is being used and tested. The evidence now at hand would indicate that the agent would bear further investigation, because it can be used in quantities of 50 to 80 cc. with remarkable results, as evidenced in the operating room as well as during the postoperative course.

The newer developments in neurosurgery cannot be mentioned without tribute to the development of anesthesiology. In operations for the removal of brain tumors, the trend has been away from the use of local or regional anesthesia. The development of different methods of anesthesia, as well as new anesthetic agents, has accounted for this. When local or regional anesthesia is employed, patients complain of the emotional strain, if not of actual discomfort, during the operation.

It was assumed that general anesthetic agents such as ether, chloroform, nitrous oxide, and ethylene, produced increased intracranial tension and therefore were more dangerous and were accompanied by a higher mortality rate than were local anesthetic agents. However, the introduction of the intratracheal tube allowed freer use of the inhalation anesthetic agents, with a greater safety from the standpoint of both mortality and morbidity. Rectal anesthesia was accepted as a safer method for the use of anesthetic agents, and is now used in some clinics almost entirely. Intravenous anesthesia has been adopted as a safe method in certain types of operations, especially when it is produced with pentothal sodium. Pentothal sodium produces anesthesia rapidly, and the patient quickly recovers from this type of anesthesia after cessation of administration of the drug.

There is no question that the introduction of the sulfonamide drugs and antibiotic agents has created a greater margin of safety in the treatment of intracranial lesions. In addition to hemorrhage and cerebral edema, the other most-feared complication of intracranial operations probably is the development of infection. Infection which followed the removal of intracranial tumors usually proceeded to either

osteomyelitis of the skull or meningitis. Today, with the use of the different sulfonamide compounds and antibiotic agents, the incidence of infection has been reduced to almost nothing. This, however, does not mean that careful aseptic technics should in any way be abandoned; in addition to the use of such technics, which always has been strictly requisite in neurologic surgery, the use of the drugs in question is an additional safeguard against complications.

ANOTHER development in the postoperative care of patients who have undergone operations for brain tumor arose from the war. During the bombardments from the air in England, it was found that patients injured about the head must of necessity be up and about earlier than the prescribed three weeks. Patients who were injured in London were treated in first-aid stations. Because of the congestion of transportation, it was often necessary for them to be up walking about, climbing into the ambulances, coaches, and other means of conveyance. Much to the surprise of everyone, these patients did much better than the patients who had been forced to remain in bed the customary three weeks.

Thus, it was learned that patients with intracranial injuries, as well as those who had undergone operations for the removal of intracranial lesions, did much better postoperatively if they were not confined to their beds. Hence, early ambulation has entered into the postoperative care of such patients. Early ambulation has been stressed in general surgery, and early ambulation is now being stressed in neurologic surgery, to be used not only after operation for cerebral trauma, but also for intracranial operations.

## SUMMARY

If intracranial lesions, and especially tumors of the brain, are suspected early and if the patients are brought to the neurosurgeon for observation and for the exercise of refinements of diagnosis such as encephalography or ventriculography, coupled with electro-encephalography and arteriography, these lesions can be diagnosed early in their development.

Earlier diagnosis of the intracranial lesion allows for earlier operation before irreparable damage has been done to the surrounding tissues within the cranial cavity, and before the patient has been confined to his bed for a long period and his general condition has been allowed to deteriorate. All of this militates toward more successful and complete removal of the operable lesions within the intracranial cavity. It allows for more extensive resection of the less benign type of lesions; even in the gliomatous group there are cases on record in which early operation, with radical removal of the tissue surrounding the tumor, has produced survivals of five to ten to twelve years.

New additions to the diagnostic armamentarium are angiography and electro-encephalography. Although these are still in the developmental stage, they have evidenced their value in contributing to the earlier diagnosis of intracranial lesions.

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DIAGNOSTIC CLINIC

# Treatment of Hepatic Cirrhosis

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In 1941 Dr. Raymond O. Muether and I reported before the Central Society for Clinical Research[1] on the successful treatment of human hepatic cirrhosis by use of a low fat, low cholesterol diet with the addition of choline. We based this therapeutic regimen on the fact that high fat, low protein diets deficient in choline produce first fatty livers and later cirrhosis in experimental animals, whereas the opposite type of diet with the use of choline may lead to recovery. We also advocated an increase in the protein content of the diet as a source of methionine in all cases with low plasma proteins. We recommended choline and methionine for their lipotropic action in clearing fatty infiltration of the liver.

The experimental studies by such investigators as Best,[1a] Channon,[2] Chaikoff,[3] Connor,[4] Gyorgy and Goldblatt,[5] Griffith and Wade,[6] and Lillie, Daft, and Sebrell[7] indicate that fatty liver is the antecedent event in cirrhosis of dietary origin; and that choline and methionine are of value in prevention and treatment.

This conception of the etiology and treatment of hepatic cirrhosis which we suggested has now been widely accepted.

In the years since 1941, we have had further experience in the treatment of cirrhosis. Certain additional factors have been found of value. In agreement with the observations of Kunkel, Labby, Shank, and Hoagland[8] and others, we have found crude liver extract of value in cirrhosis. This we reported to the Central Society for Clinical Research in November 1946.[9]

The following cases are illustrative of the use of various procedures which may influence the course of cirrhosis. The diet which we described in 1941 was relatively low in fat and cholesterol. This was based on the fact that we had produced cirrhosis in rabbits on diets high in fat and cholesterol.

## CASE REPORTS

*Case 1*—A white female, 52 years of age, entered St. Mary's Hospital on March 5, 1939. Her previous physician stated that her liver had been palpable for several years. She developed progressive abdominal enlargement beginning in December 1938.

Physical examination revealed that her heart was not enlarged and there were no murmurs; blood pressure was 120/80; no leg edema was present. Her abdomen was distended with enlarged superficial veins, and the liver was hard, rough, and greatly enlarged. The spleen was palpable, and the presence of ascites was noted, indicated by fluid wave and shifting dullness. Her red blood cell count numbered 4,700,000; hemoglobin 14 gm. per cc.; hematocrit 43 per cent, and white blood cell count 9,100. Icterus index was 6 units, and fasting blood sugar 235 mg. per cent. The urine contained 5.0 gm. glucose in twenty-four hours.

Insulin was prescribed first on March 8, 1939, and raised gradually from 5 units three times

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G. O. BROUN

daily to 10 units three times daily (regular insulin). On this regimen, the blood sugar fell to normal and the urine became sugar-free. Treatment with insulin was discontinued on October 6, 1939, and the diabetes remained under control as long as the recommended diet was followed.

The diet prescribed for this patient consisted of 60 gm. protein, 40 gm. fat, and 250 gm. carbohydrate.

On August 24, 1939, the liver was smaller and no ascites were present. On February 16, 1940, the liver was barely palpable, with no ascites. This patient remained well for two years and then had a relapse of diabetes due to neglect of diet. This case illustrates recovery from ascites in a case of cirrhosis on a diet low in fat but normal in protein content, without the use of lipotropic substances.

As EARLY as 1937, Patek[10] had secured encouraging results in the treatment of hepatic cirrhosis by a highly nutritious diet rich in vitamin B complex. He used no purified lipotropic substances and gave as the basis of use of his diet merely the evidence of nutritional deficiency seen in cirrhosis. His diet was sufficiently high in protein so that it contained an ample supply of methionine and the yeast which he included contained some inositol and choline. Hence it was actually a diet which could be expected to cure fatty liver and so be of value in cirrhosis.

Patek's cases illustrated well the fact that if protein intake is sufficiently high, it is not necessary that purified lipotropic agents be used. The diets of Patek[11] contained from 115 to 139 gm. of protein per day. Although protein alone can be effective, we have had instances in which choline added to diets of normal protein content resulted in clinical improvement in cases of cirrhosis. It is our contention that supplementary use of choline will aid in recovery on diets of much lower protein content than would otherwise be required, as is illustrated by Case 2.

*Case* 2—A white female, 65 years of age, with a dietary history of anorexia and a definite dislike for protein foods, had noted some enlargement of the abdomen since June 1945. She stated that she seldom ate meat or eggs and that fried foods caused "indigestion." Her alcoholic intake consisted of two bottles of beer daily and an occasional glass of wine. In December 1946 she noted a rapid increase in abdominal distention, followed by moderate leg edema, progressive pallor and weakness.

Laboratory findings were as follows: white blood cell count, 2,550; red blood cell count, 3,560,000; hemoglobin, 8.5 gm. per cc.; no albumin in urine; nonprotein nitrogen in blood, 29 mg. per cent; blood sugar 103, plasma albumin 3.83 mg. per cent, and plasma globulin 2.91 mg. per cent. Icterus index was 12 units. The Takata-Ara test was positive in thirty minutes, and cephalin flocculation positive in twenty-four hours. Thymol turbidity was 10.5 units, with 60 per cent retention of bromsulfalein in one hour.

After paracentesis was carried out on Decem-

ber 15, 1946, a small, hard liver was felt beneath the costal margin. On December 18, 1946, a diet consisting of 65 gm. protein, 80 gm. fat, and 200 gm. carbohydrate was prescribed. This diet was supplemented with 1.0 gm. of choline chloride daily.

The patient showed marked clinical improvement and abdominal ascites cleared in six weeks, after which she remained well for four months. At the end of this time, she suffered a severe gastric hemorrhage after a period of great emotional stress, and the symptoms of cirrhosis reappeared.

Most of our cases have been treated with low fat, high protein, and high carbohydrate diets supplemented with choline. Case 3 illustrates the effect of such a diet.

*Case 3*—A white male, 74 years of age, was observed in the outpatient department on March 4, 1943, and entered the hospital on March 20, 1943. His history revealed that he drank heavily up to twenty-five years ago, when he ceased drinking alcoholic beverages. He disliked and seldom ate meat, and seldom drank milk. He ate eggs occasionally, and was very fond of fried foods and butter.

Examination showed his heart to be slightly enlarged to the left. A systolic aortic murmur was noted, believed due to aortic roughening. Blood pressure was 140/80, rate 70 beats per minute. Examination of the lungs gave negative findings. The abdomen was distended; the liver was firm and somewhat rough and extended five finger breadths below the costal margin. The spleen was not felt. Shifting abdominal dullness indicated that ascites were present.

Paracentesis was carried out on March 22, 1943, and 1,800 cc. of ascitic fluid was removed. Following this, the leg edema cleared in five days. The patient's white blood cell count numbered 5,400; red blood cell count, 4.72, with 16.5 gm. hemoglobin and a hematocrit reading of 49 per cent. Prothrombin time was 60 seconds with a normal control of 34 seconds. Icterus index was 40, with prompt direct Van den Bergh reaction. The nonprotein nitrogen was 35 per cent; blood sugar, 85 mg. per cent; blood cholesterol 160 mg. per cent; plasma albumin 2.91 mg. per cent; plasma globulin 2.31 mg. per cent; hippuric acid synthesis 0.687 gm.; bromsulfalein, only trace at 30 minutes. The Kahn test was negative, the Takata-Ara test positive in twenty-four hours.

The diet prescribed contained 115 gm. protein, 75 gm. fat, and 350 gm. carbohydrate, supplemented with 1 gm. choline chloride daily and 5 Navitol gtts. two times daily.

Ascites cleared in three weeks and has not reappeared. The liver has decreased in size and the patient has remained in good health for four and one-half years.

In addition to this, some cases appear to need supplements of crude liver extract. The active substance in this liver extract is unknown. Case 4 illustrates the use of a constant diet containing 100 gm. of protein supplemented by choline and later by liver extract.

*Case 4*—A white male, 59 years of age, entered the hospital on September 28, 1939. He admitted a heavy intake of alcoholic liquors up to 1937, when abdominal enlargement was noted and he ceased drinking. Marked abdominal enlargement and swelling of the legs occurred in June 1939. At this time his attending physician placed him on a high protein diet. This diet improved the leg edema, but the ascites became worse and a paracentesis of the abdomen was resorted to on eleven occasions between June and September of 1939.

The patient showed no cardiac murmurs or arrhythmia. The blood pressure was 120/76. Following paracentesis, the liver could be palpated and was found to be enlarged and hard. The spleen was not felt. The superficial abdominal veins were moderately prominent. The ascites reaccumulated rapidly after each tapping, but there was no visible jaundice.

Prior to treatment, the laboratory findings were as follows: urinalysis revealed moderate albuminuria and occasional leukocytes. Just before treatment was begun, the leukocyte count was 5,200 per cubic millimeter, the erythrocyte count was 3,500,000, and the hemo-

globin was 13.7 per cc. The differential showed 60 neutrophilic segmented forms, 1 per cent eosinophiles, 7 per cent monocytes, and 18 per cent lymphocytes. The Kahn blood test was negative. Blood sugar tolerance by the Exton Rose method—fasting 99 mg. per cent, 30 minutes; 143 mg. per cent, 60 minutes; 136 mg. per cent. Hippuric acid synthesis was 2.3 gm. in a four-hour period. The Takata-Ara test was positive. The prothrombin time was 27 seconds with a normal control of 20 seconds. The nonprotein nitrogen was 35 mg. per cent, plasma albumin 1.2 mg. per cent, plasma globulin 3.2 mg. per cent, and blood cholesterol 296 mg. per cent.

At the end of September 1939 this patient was placed on a diet of 100 gm. protein, 60 gm. fat, and 250 gm. carbohydrate; this diet was maintained constantly throughout the period of treatment. During the first six weeks of treatment, no special dietary supplements were added, and the patient's condition was growing steadily worse. At the end of the first week in November 1939, choline chloride in a dosage of 1.0 gm. daily was added to the diet. A slow but definite clinical improvement followed. The accumulation of ascites which required tapping every few days decreased slightly, but progressively, from the level noted on dietary treatment alone. Appetite improved and from a nearly moribund condition, the patient was able to be up and active. Some increase in plasma proteins was also noted.

In February 1940 crude liver extract—prepared from Lilly's powdered extract #343—was given intramuscularly in a dosage of 3.0 cc. three times weekly. By August 1940 the patient was so improved that he was discharged from the hospital, and treatment was continued in the outpatient department. Choline therapy was continued, but liver extract was discontinued. The accumulation of ascitic fluid gradually lessened in the next few months and in January 1941, accumulation of the fluid ceased. The patient has remained well until the present date. Choline and liver extract both appeared to be beneficial in this case. However, complete recovery occurred in the last five months on choline alone without liver extract.

In 1941, Gavin and McHenry[12] showed that inositol possessed lipotropic properties, and we have also had some experience with this substance.

*Case 5*—A white male, 53 years of age, had noted impairment of strength for one year prior to admission to the hospital. He gave a history of beer drinking amounting to ten or more bottles per day. His appetite was poor, and his diet consisted largely of eggs, potatoes, creamed vegetables, and beer. Vomiting was a daily occurrence shortly before admission. Ascites indicated by abdominal enlargement began two months prior to hospital entry. There were no cardiac murmurs and the blood pressure was 140/70.

The abdomen was greatly distended and enlarged superficial veins were present in the abdominal wall. The liver extended 3 cm. below the costal margin and was hard and rough. The spleen was not felt. Some leg edema was present.

Laboratory findings were as follows: white blood cells numbered 6,700; red blood cells numbered 1,970,000; hemoglobin 8.5 gm. per cc.; prothrombin time was 66 per cent; blood sugar 103; nonprotein nitrogen 27 mg. per cent. The Kahn blood test was negative. Plasma albumin was 2.96 mg. per cent, plasma globulin 2.20 mg. per cent, blood cholesterol 160 mg. per cent. Hippuric acid synthesis was 0.216 gm.; the Takata-Ara test was positive in twenty-four hours; cephalin flocculation was 3+ in forty-eight hours, with 50 per cent retention of bromsulfalein in thirty minutes.

On August 24, 1944, treatment was begun with a diet consisting of 116 gm. protein, 75 gm. fat, and 350 gm. carbohydrate. In addition, two tablets of fortified yeast three times daily, two capsules of Lextron ferrous three times daily, and 1 gm. choline chloride daily were administered. In spite of this treatment, clinical improvement was slow during the following four months, and repeated paracentesis was necessary.

On January 1, 1945, the liver extract was discontinued and inositol in a dose of 1 gm. daily was added. The choline, yeast, and diet were continued. Ascites then accumulated more slowly, and after one paracentesis was done on February 8, 1945, no more were necessary and the patient made a complete recovery.

THE CASES of cirrhosis included in this report, we believe, were all of dietary origin due to low protein diets with the addition of a heavy alcoholic intake in many cases.

We have observed numerous cases of cirrhosis in cardiac cases in which prolonged passive congestion appeared to be the chief etiologic factor. Results of treatment in these cases depend on the possibility of securing compensation of the heart lesion. If this can be done, we feel that the treatment suggested for dietary cirrhosis is of help.

We have also observed a number of cases of cirrhosis developing as a sequel of hepatitis—the cholangiolitic cirrhosis of Watson.[13] Watson[14] believes that these cases occur without antecedent fatty changes. We have found that these cases respond poorly to treatment with lipotropic substances. Nevertheless, we feel that the high protein diet, supplemented with lipotropic substances such as choline, inositol, and yeast, with the possible addition of crude liver extract, offers an optimum opportunity for recovery in these cases.

Cystine has been shown to be necessary for the prevention of hemorrhagic necrosis of the liver. It may also be a useful adjunct in the treatment of cirrhosis. We have not yet made studies of its use in this condition, however.

The deficiencies present in cirrhosis are often multiple, and I do not maintain that simple addition of choline is all that is needed for ideal treatment. But it appears to be one of the factors which are of value in fatty liver, and with it, success in treatment of cirrhosis can probably be attained on lower levels of protein intake than would otherwise be required. The same is probably true of cystine, inositol, and liver extract. Furthermore, any vitamin deficiencies, e.g., thiamin, niacin, riboflavin, and vitamin A must be corrected, and there is some evidence that a rich intake of tocopherol is advisable.

It should be stressed that treatment of cirrhosis must extend over a long period of time, often many months, before success is attained in some cases. After apparent cure has been obtained, it is all-important that a highly nutritious diet, rich in proteins, be continued and that exposure to alcohol be strictly avoided. We also usually recommend the long-continued use of choline, because we have seen many prompt relapses when this regimen is neglected. We have cases who persisted in treatment and are now free of symptoms from three to five years after recovery from cirrhosis of the liver with ascites.

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DIAGNOSTIC CLINIC

# Bodily Reactions of Anxiety

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ANXIETY is the universal disease of our times. Probably at no other time in history were so many millions of people more conscious of the fact that anxiety is widespread, that insecurity is commonplace, and that fear of the future is a universal phenomenon. Insecurity and anxiety develop so early in life that some authors have suggested that the act of being born might be considered as an experience in which the syndrome of primary anxiety is established.

It is well accepted that early environmental factors act to frustrate, partially or completely, the child's basic drives. All children, from birth onward, have their basic drives and a desire to satisfy these urges and thus feel secure. If this is not possible, if hunger is not satisfied, if love and affection are not forthcoming, such a child will obviously show tension. Such frustrations lead to a conflict between the basic drives and the external world; and such a conflict generates anxiety. When this occurs, the drive remains in full force, and continues to seek satisfaction, but the anxiety now causes the child to repress the drive, or to seek other means of control over it.

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The method which is used to control anxiety will determine the clinical features of the personality disturbance in the patient. Although this anxiety may appear in several forms, it is important to realize that the anxiety itself is the predominant and underlying emotional reaction. In Table 1, we see the major factors involved in producing anxiety reaction.

There is also present in each of us a *normal* anxiety, that which results from adequate and known external causes that are accompanied by an element of doubt as to outcome. Such an anxiety reaction, within limits, keeps the personality alert and adjusted and is used by the ego in preparation for defense. Anxiety becomes pathologic when it recurs persistently in inappropriate situations, in reaction to inappropriate stimuli, and in response to factors of which the patient is unaware, factors which are now unconscious. Such anxiety may be either "free floating" and directly experienced and felt, or it may be unconsciously and automatically controlled by the utilization of various psychologic defense mechanisms (repression, conversion, displacement, etc.). In the somatization of anxiety, the anxiety is relieved by channeling the original conflicting impulses through the autonomic nervous system into visceral organ symptoms and complaints. These reactions represent the visceral expression of

the anxiety which is thereby largely prevented from becoming conscious.

Franz Alexander has remarked that all our emotions are expressed by physiologic or bodily processes—sorrow, by weeping; amusement, by laughter; and shame, by blushing. All of our emotions are accompanied by physiologic changes—fear, by heart palpitation; anger, by increased heart activity, elevation in blood pressure, and a change in carbohydrate metabolism; despair, by deep inspiration and expiration called sighing. In somatization reactions, the symptom results from a chronic and an exaggerated state of the normal physiology of the emotion, with the feeling or subjective part repressed. Long-continued visceral dysfunction may eventuate in structural changes.

Several reliable physicians have written that from 30 to 50 per cent of all persons seeking medical advice are suffering from emotional conflict expressing itself in bodily complaints. Medicine is no longer interested only in symptoms or in diseases of a particular organ; we are now concerned with the *person* who is sick, and how that person is reacting to his illness. We treat the patient, not the disease. The false separation between the physical person and his emotions no longer exists. We recognize our patient as a complete human being with all of his hopes, his problems, his individuality, and still living in the social world about him. In Tables 2, 3, and 4, we observe the many and variable signs and symptoms of an anxiety reaction.

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World War II exemplified on a mass scale the physiologic somatization repercussions of anxiety. The psychiatrist was called as a consultant to all the sections of the hospital and somatization reactions involving almost every organ and system were seen. In a combat situation the soldier was beset by multiple emotional and instinctual conflicts. His ingrained ideals of loyalty, self respect, and group feeling constantly collided through the emotion of fear with his instinct of self-preservation. Anxiety was certainly not just a mental state, but also a bodily one and the physical signs of disturbances of the gastrointestinal tract with vomiting and diarrhea, a dry mouth, sweating of the palms of the hands, palpitation, and tremor were not infrequently present. The emotional state resulting between his conflict of instinct for escape and desire to serve frequently became so severe that the physical symptoms became exaggerated and the soldier was incapacitated for further duty. The clinical types of anxiety are shown in Table 5.

We have come to realize that emotional stress, as well as certain physical changes, can cause palpitation, precordial pain, and transient hypertension. A patient suffering from a severe depression not infrequently manifests the biologic concomitants of anorexia, bradycardia, weight loss, decreased gastrointestinal motility, and severe constipation. Emotional impulses mediated through the autonomic nervous system are mirrored in the somatic changes involving single or multiple organ systems.

There is some clinical evidence that the hypo-

TABLE 1

FACTORS IN PROCESS OF ADAPTATION TO AN ANXIETY REACTION

| THE PERSONALITY | THE SITUATION | THE REACTION |
|---|---|---|
| Tolerance or capacity for enduring frustration, tension, or anxiety | Social anxiety in relation to group acceptance and belonging | Anxiety-reducing mechanisms |
| Neurotic and immature attitudes | Educational and vocational difficulties | Phobic<br>Compulsive—obsessional and addictive<br>Depressive<br>Hypochondriacal<br>Hysterical |
| Enthusiasms, loyalties, group identification, and morale versus resentments and aversions | Family and marital problems | |
| Mental capacity, intelligence, special knowledge, and skills | Establishment of independence | |
| | Physical disability, by infectious diseases or other causes | Organic fixations of anxiety (psychosomatic disorders)<br>Musculoskeletal tensions<br>Gastrointestinal disorders<br>Cardiovascular disturbances<br>Other |
| | Special issues | |

thalamus serves as the relay center for the conversion of emotional compulses into autonomic and endocrinologic effects. However, a tendency to overemphasize the importance of the hypothalamus in the emotional aspects of behavior has existed. It should be strongly emphasized that emotion is a highly integrated affective—autonomic—somatic reaction in which the entire organism functions as a psychobiologic unit.

The hypnotic reproduction of painful emotional stimuli can frequently experimentally produce the somatic manifestations of the illness. These manifestations are intimately bound to the sympathetic and parasympathetic nerve balance, and that of the adrenergic and cholinergic substances that mediate the nerve impulses. In an intense emotion such as fright, adrenergic responses have a generalized reaction in preparing the organism for motor activity. At the same time, more local cholinergic responses occur which are concerned with the actual muscular contractions.

Emotional excitement frequently involves both branches of the autonomic nervous system. Bulbocapnine, metrazol, and cocaine are capable of stimulating both sympathetic and parasympathetic fibers.

Myerson and his associates[10] showed that the intravenous administration of epinephrine gave effects which overshadowed those produced by the simultaneous administration of mecholyl. In the application of such investigations to clinical medicine, it is possible that adrenergic substances liberated during emotional outbursts exert an inhibitory effect on the already damaged cholinergic mechanism.

ON THE basis of experiments carried out on decorticate animals, and experiments utilizing direct stimulation of the hypothalamus, it must be concluded that it is this region that represents the expression of emotion. Sympathetic-adrenal responses predominate, but parasympathetic effects may also be obtained from stimulation of the hypothalamus. Emotion, then, may be characterized by sympathetic and parasympathetic discharges from the hypo-

TABLE 2

SPONTANEOUS COMPLAINTS OFFERED BY PATIENT WITH ANXIETY REACTION

1. Difficulty in breathing
   - Choking
   - Lump in throat
   - Can't breathe in
2. Precordial discomfort
   - Pain, pressure, and weight on chest
   - Squeezing of the heart (often with ill-defined radiations)
3. Palpitation of heart
   - Pounding
   - Skipping
   - Fluttering
   - Racing
   - Stoppage or "heart attack"
4. Vertigo
   - Giddiness
   - Swimming in head
   - Faint feelings
5. Perspiration
   - Cold sweats
   - Shivery feeling
   - Goose pimples
6. Weakness
   - Knees give way
   - Energy all gone
   - Paralyzed
7. Gastrointestinal disturbances
   - Gas on stomach
   - Gas crowding the heart
   - Sick to stomach
   - Epigastric cramping
   - Abdominal soreness
   - Diarrhea
   - Flatulence

TABLE 3

COMPLAINTS REVEALED ON QUESTIONING PATIENT

1. An emotion of anxiety, manifested by:
   - Fear of indescribable danger from within
   - Fear of impending physical illness
   - Fear of something unpleasant about to happen
2. Concern over mental abilities
   - Feeling of being worried
   - Slowing of thinking
   - Feeling "confused"
3. Further complaints in physical state
   - Headache
   - Fatigue
   - Irritability
   - Restlessness
   - Difficulty in sleeping
   - Anorexia

TABLE 4

FINDINGS ON EXAMINATION OF THE PATIENT

1. General behavior
   - Tenseness
   - Restlessness
   - Uneasiness
   - Apprehension
   - Clothing loosened at neck
2. Skin and mucous membranes
   - Cold, moist hands and feet
   - Dry mouth and lips
3. Cardiovascular
   - Variable pulse rate
   - Variable blood pressure
   - Heart sounds often hyperkinetic
4. Abdomen
   - Frequently spastic
   - Tender colon
5. Neurologic
   - Brisk to hyperactive muscle-tendon reflexes

thalamus. Certainly the hypothalamus may produce certain somato-autonomic changes that accompany or reflect emotion, but this is not emotion itself.

THE autonomic nervous system is arranged in the central nervous system at different levels. At times the cerebral cortex appears to possess the capacity to inhibit certain autonomic centers in the hypothalamus. Emotions or the observation of the bodily changes caused by autonomic stimulation may well arise from discharges from the cerebral cortex. The affective processes may be related especially with the frontal lobes. Frontal lobotomy may lessen or diminish emotion and its bodily manifestations. Changes in the electroencephalogram in the frontal leads are often seen early in electric shock therapy. Kennard[9] feels that the interaction between the autonomic and somatic nervous systems with emotional display takes place mainly through the extrapyramidal system in the forebrain.

Bieber and Tarachow[3] studied autonomic symptoms in psychoneurotics utilizing analytic technics and concluded that autonomic symptoms in neurotics were parts of a total attitude in which there was either a heightening or collapse of efforts at mastery. They presented clinical data to illustrate the various excitatory and inhibitory phenomena comprising the abnormal efforts in mastery or tensions and anxiety created by an inability to handle certain situations in the environment. The most common symptoms noted were sleep disturbances, conjunctional congestion, salivary and menstrual irregularities, and disturbances of skin function.

Further, there are certain types of illnesses in which emotional factors play an important role. Dunbar[5] and French and Alexander[7] have all done considerable original work along these lines and the following material has been summarized from some of their conclusions on the types of psychosomatic illnesses.

### HEADACHE

Headache occurs in a great variety of diseases. It is not within the scope of this paper to discuss headache from an overall clinical viewpoint. The intracranial vessels are under control of the autonomic nervous system. The production of headache through reflex action from various parts of the body and in excitement and emotional states, is feasible on the basis of vasomotor changes.

In general, however, we find the emotional type of headache in patients who exhibit a characteristic type of personality.[5] They are sensitive, tense, highly intelligent, and "highly strung," and are perfectionistic, stubborn, and often impatient with the slowness and faults of others. Such a person usually takes life seriously and feels his responsibilities keenly. He has probably always been poorly adjusted to life and had many problems, worries, fears, and compulsive ideas. Often this individual has a nagging problem which is impossible to

TABLE 5
CLINICAL TYPES OF ANXIETY

| NORMAL | ANXIETY STATES | ANXIETY STATES | ANXIETY REACTIONS | ANXIETY |
|---|---|---|---|---|
| Resulting from adequate and known external causes that are accompanied by an element of doubt as to outcome (parent reaction to recovery or death of sick child) | Associated with *or* symptomatic of bodily disease, toxic condition, and organic brain changes | Arising from situational difficulties of which the person is more or less aware—i.e., "conscious" factors (often occurring on basis of constitutional-personality traits in conflict with external factors) | Arising from factors of which the patient if unaware—i.e., "unconscious" factors (often closely connected with sex instinct motivations) | Occurring in psychoses |

solve and yet at the same time is intolerable to him. The main emotional feature is one of repressed hostility.

The sensitivity of the vessels in the pia mater and dura mater has shown that probably many headaches are of vascular origin, the pain being due to stimulation of the immediate nerve endings or vasodilatation. The fact that headache follows an encephalogram also indicates that more centrally located parts of the brain are also sensitive.

Simons and Wolff[15] in their studies on headache feel that the prognosis on post-traumatic headache cannot be generally expressed, as much of the outcome depends on the rapport between the physician and patient and an appraisal of pre-accident emotions such as despair, frustration, anxiety, and resentment.

The exact mechanisms causing migraine headaches are not yet clear, yet a disturbance in the gonado-pituitary mechanism is to be considered and certainly emotional stress is known to precipitate attacks.

### PSYCHOGENIC GASTROINTESTIONAL REACTIONS

Anorexia nervosa is an old term that merely means loss of appetite on an emotional or neurotic basis. Some type of emotional upset usually precipitates the condition. Psychosomatic manifestations may include amenorrhea, low metabolic rate, and weight loss. On some occasions the clinical picture may be so severe as to remind the physician of Simmonds' disease or atrophy or degeneration of the anterior lobe of the pituitary. An analytic interpretation of this illness usually brings out a psychosomatic illness in which fantasies of oral impregnation are dramatized through starvation, vomiting, and amenorrhea. Frequently cases with adequate intellectual capacities may respond to prolonged psychotherapeutic technics when all other attempts at treatment fail.

Therapy of anorexia nervosa is difficult if it is limited to medication. Anterior pituitary hormone is of no avail. Thyroid medication may merely cause more weight loss and the use of insulin is not indicated as a hypoglycemia exists in most cases. Bed rest, small frequent feedings, or tube feedings may help, but a resolution of emotional conflicts is essential for adequate rehabilitation.

THE act of swallowing is a complex one and central nervous tissue comprising this coordinated mechanism is therefore diffuse and extends throughout the pons and medulla. The cardia is supplied with both motor and inhibitory fibers from the vagus; however, the chief influence exerted by the vagus is probably inhibitory, but depends on degree of tone in the cardia. A spasm occurs when the sphincter does not relax properly and the patient states "I can't get food down, it sticks in my throat."

Faulkner[6] has shown conclusively, by means of esophagoscopic examination, that suggestions of undesirable environments caused esophageal tightening and narrowing of the lumen. On the other hand, proposals of a pleas-

ant situation brought about a prompt relaxation of the spasm, and return of the lumen to its normal size. This author further demonstrated that the range of the diaphragmatic movement can be altered by suggesting imaginary situations arousing strong emotions. Pleasant emotions caused increased amplitude of diaphragmatic movement and unpleasant emotions restricted the expansion of the diaphragm. Thus cardiospasm may be related in some way to the tightening of the esophageal diaphragmatic pinchcock. It is probable then, that so-called idiopathic cardiospasm may be due to unpleasant emotional stress. At autopsy the functional stenosis has usually disappeared, but the esophageal dilatation remains.

Under the influence of anxiety and tenseness the tone of the stomach and the amplitude of the gastric contractions usually decrease. At the same time secretion of the gastrointestinal juices may be inhibited.

Pavlov's experiments many years ago on conditional reflexes demonstrated that pleasurable emotions associated with food intake may lead to the excitation of the parasympathetic system.

Brunswick[4] attempted to correlate gastrointestinal changes with various types of emotions. He felt that in general surprise and unpleasantness were associated with an increase in tone, and fear produced a decrease in tone. These results were certainly not constant and it is not correct to state that pleasurable emotions are associated with an increased activity of the parasympathetic, and unpleasant emotions with an increased sympathetic function. Under conditions of fear, increased parasympathetic activity is often seen, such as diarrhea, increased peristalsis, and spastic sphincters.

## PEPTIC ULCER

Recently increased attention has been focused on peptic ulcer and the autonomic nervous system as a result of the surgical procedure of cutting the vagus nerve. Long ago, Cushing suggested that influences arising in the parasympathetic center in the hypothalamus were conveyed along the vagus nerves, and were responsible for changes in the gastric mucosa that led to the development of peptic ulcer. The injection of the parasympathetic stimulant pilocarpine into the third ventricle or the continued stimulation of the vagus nerve also has produced hyperemia and erosions of the gastric mucosa.

Peptic ulcer occurs predominantly in young men who are usually ambitious, energetic, keen, conscientious, and have a tremendous drive for success. But this individual also has underlying feelings of inferiority with consequent overcompensation and a very marked conscious drive for superiority. He has deep-seated dependency feelings and a need for affection. In some ways it is this "hunger for affection" that keeps his stomach juices overstimulated and leads to the development of the peptic ulcer.

Harris[8] reviewed the case histories of 200 patients admitted to a military hospital for the treatment of minor psychiatric conditions. There were 25 patients who had as their chief difficulty, distress and symptoms referable to the upper gastrointestinal tract. These symptoms had appeared during some period of their military service. The emotional attitude of this group, as compared with the others, was that of conscious and freely expressed anger and resentment.

Mittelmann and Wolff[14] studied emotions and gastroduodenal function. Precipitating emotional factors in 30 unselected patients with peptic ulcer were guilt, frustration, resentment, anxiety, and insecurity. Situations were experimentally created which included strong unpleasant emotional feelings and these precipitated symptoms when the patient was previously symptom-free. With unpleasant feelings an increase of hydrochloric acid, mucous, and pepsin secretions were noted. The motility and mucosal activity of stomach and duodenum were also increased.

The large bowel is likewise susceptible to psychic factors and mucous colitis is frequent-

ly encountered in patients with psychogenic disturbances. This illness occurs predominantly in inhibited, possessively dependent women of 40 to 50 years of age. They usually have a long illness record, a history of several operations, and a long cathartic habit. The predominant clinical picture is one of tension occurring in an individual who is often a depressed person who broods over failures, and who has many aggressive feelings that have been repressed.[5]

### PSYCHOGENIC GENITOURINARY REACTIONS

It is not surprising that the renal system should be subject to emotional stress due to its close functional relationship to the genitals. Ahronheim[1] studied emotional albuminuria under combat conditions and found the amount of albumin excreted under emotional tension fluctuates greatly but will follow a pattern which seems to be different for each individual. It was found that a combat mission represents a powerful emotional stimulus causing intermittent albuminuria. Urination is a well-known bodily expression of anxiety and usually enuresis in children is on an emotional basis. Enuresis occurring beyond the age of 10 years is a definite neuropathic trait.

The secretion of gonadotropic hormones is regulated mainly by the hypothalamus and is intimately interrelated with the autonomic nervous system.

The exact nervous pathways involved are not known at the present time. Benedek and Rubenstein[2] have shown that the psychosomatic unit of the mature human female is indeed a complex one and that a diversity of emotional reactions can be correlated with specific variations of hormone production.

The basic normal pattern of physiologic and personality relationships may be stated as follows: Following menstruation there is a gradual increase for ten days to two weeks of the estrogenic or follicular hormones, and paralleling this in a psychologic manner, an extratensive feeling with interest in the opposite sex. After ovulation occurs, the effects of the estrogenic hormones are masked by the increase of the corpus luteum hormone, progesterone. Psychologically, with an increase of progesterone, flightiness, irritability, decrease in amount of interest in the opposite sex, and increased interest in the woman herself, occur. There is an emotional preparation for nidation and motherhood. During the late premenstrual period the ego becomes weak. The emotional state at this time may be often characterized clinically as a depression. Women may be somewhat retarded, sad, asthetic, indifferent, fatigued, and evidence more marked emotional lability. Psychosomatic reverberations sometimes occur during the premenstrual phase such as migraine, gastric distress, constipation, and skin eruptions. The pregnant woman is prepared both physiologically and emotionally for her motherhood and offspring. The interrelationship between emotional conflicts, the endocrine system, and the autonomic nervous system are intimate, complex, and of great psychosomatic significance.

Frigidity, sterility, amenorrhea, and low back pain are all too frequently merely psychosomatic manifestations of emotional conflict. One of the most fertile fields for further psychosomatic research is in the branch of obstetrics and gynecology.

### PSYCHOGENIC CARDIOVASCULAR REACTION

The coronary arteries are supplied by both vagal and sympathetic fibers. It would seem that the coronaries are dilated by sympathetic impulses and constricted by the vagus. The vagus, of course, acts through the liberation of acetylcholine and this substance has been demonstrated in the coronary blood during vagal stimulation. The coronary vessels have afferent fibers from both the vagus and the sympathetic. The abdominal and thoracic viscera may send reflexes to the coronaries.

The practicing clinician is well aware of the fact that anginal attacks are commonly precipitated by work or some type of emotional excitement. The pain itself is apparently due to the subsequent anoxia of the heart muscle. In managing a case of angina the clinician at-

TABLE 6
PROCESS OF THERAPY IN THE ANXIETY REACTIONS

| THE AIM OF TREATMENT IS TO ESTABLISH: | ACHIEVEMENT OF THESE AIMS INVOLVES: |
|---|---|
| Appreciation of relationships | Understanding of problem |
| Rapport | Guidance |
| Emotional experience | Suggestion |
| Removal of causes | Emotional participation |
| Reconstruction | Social therapy |
| Emancipation | Emancipation |
| | Somatic therapy |

tempts to soften the environment and help the patient develop a philosophy of life in which emotions may not play such an important role.

The occurrence of hypertension and hypertensive heart disease is frequent in our present culture. Such an individual usually has a high illness record, usually is married with a large family, often has other neurotic symptoms, usually had strict, domineering parents, and has seen cardiovascular disease or sudden death in his family or background. There is a life-long conflict in the sphere of authority, particularly with a fear of criticism or a fear of falling short. There is also a desire to be dominant, long-standing repressed hostility, and a tendency to resort to "wine, women, and song" in the face of stress.[5]

Wolff[13] made day-to-day studies over a period of a year on the symptoms and cardiovascular and respiratory functions of healthy human subjects and short term observations on selected patients. He demonstrated that heart pain in the presence of narrowing of the coronary arteries may result from increased cardiac strain resulting from increased cardiac output and elevated blood pressure in association with rage, resentment, anxiety, fear, and tension. Giddiness and faintness may result from cerebral anoxia due to diminished venous return to the heart and may occur in response to stress and strain of certain emotions, such an anxiety and fear.

Weiss[12] recently reported a case of severe peripheral vasospasm affecting chiefly the lower extremities. This case failed to respond to ordinary therapy, but after six months it completely cleared as a result of one week of intensive psychotherapy. Obviously emotional and psychogenic factors play a role in the course of peripheral vascular disorders. The success of surgical sympathectomy in cases of hypertension may be explained on the basis of the mechanical interruption of the autonomic nervous system—the real connection between emotions and the vascular system.

The problem of fever or hypothermia of unexplained origin is one of the most puzzling the clinician may face. Circulation plays an important role in the regulation of body temperature. Circulatory reflexes via the autonomic nervous system are influenced by varying environmental situations which call the temperature regulating mechanisms into action via the heat regulation center in the hypothalamus. Ziegler and Cash[16] studied the surface temperature of 20 patients who were subjected to some emotional strain and measured the results by special technical instruments. They concluded that emotions may produce surface temperature deviations, variable in duration, even to the extent of fever or hypothermia.

## PSYCHOGENIC RESPIRATORY REACTIONS

It is well known that the respirations are under voluntary control for relatively short periods of time. The nerve impulses to "hold the breath" probably arise from cells somewhere in the motor area of the cerebral cortex, hence it is not illogical to assume that the respiratory system may be strongly affected from emotional stimuli arising in the higher cerebral cortex and mediated via the autonomic nervous system.

For the past several decades it has been theorized that emotional energy could be responsible for the production of asthma, so certainly the psychogenesis of this disease is no new idea. The outstanding personality traits of asthmatic children are their overanxiety, their lack of self-confidence, and their clinging dependence on parents. Usually the family background includes a rejection of the child by one or both parents; compensation for this by overprotective and oversolicitous attitudes on the part of

the parents; and then the resulting feelings of insecurity on the child's part with constant fear of failure of emotional support from the parents. Often the asthmatic attacks tend to be precipitated by a situation which threatens a separation from the mother. In adult life the attack may result from feelings of insecurity.

McDermott and Cobb studied 50 cases of bronchial asthma from a psychiatric viewpoint and found that 37 of the 50 cases appeared to have an emotional component in the asthmatic attacks. French and Alexander[7] stated that some asthmatic attacks appear to be brought on by allergic factors alone, emotional factors alone, or a combination of emotional and allergic factors.

In this paper we have considered the universality of anxiety in order that we may realize it is the basic factor in somatization reactions. We have not attempted a discussion of the treatment process in the anxiety states, but we would like to summarize the aims and means of therapy in Table 6.

In all of us, our adjustment varies from day to day. We all have our "good days" and our "bad days." And none of us is a perfect success, or a complete failure. In many ways our adjustment is like a hanging pendulum, which can be swayed from side to side by various factors or forces acting on it, but returns to a central resting state when the force is removed. Some of us are thrown off balance more easily; others of us require greater stresses or forces to disturb our equilibrium.

The tendency toward emotional illness is a *quantitative* thing—in some the tendency is small, and the stress has to be great; in others where the tendency is greater, the stress can be less. The causes of all behavior, of all human motivation, are much more likely to be in the realm of the unconscious than we usually realize or are willing to admit. And such causes are always multiple; there is almost never a single cause in any emotional illness.

In any period of maladjustment we must always consider at least four factors—the previous experience of the individual, his own personality structure, his own personality needs, and the environmental, social situation itself.

Man is an integrating organism maintaining a balance between the external and internal forces which determine his activities. When the organism's internal forces become chronically strained through unrelieved emotional tension, through efforts to adjust to or escape from trying personal and interpersonal situations, then disordered personality functioning is the result.

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DIAGNOSTIC CLINIC

# Chronic Lung Failure

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OUR GRANDFATHERS in medicine were preoccupied by a welter of acute diseases in young patients; in their day, those who chanced to survive much past 50 years of age were considered to be living on borrowed time, and their complaints were accepted as natural and inevitable. Now that acute infections are uncommon and the expectancy of life has increased from 35 to 65 years, much of our time must perforce be spent on the management of the diseases harshly called "degenerative" or, euphemistically, "geriatrics."

When an elderly patient comes complaining that he is failing, we cannot dismiss him with complacency and cannot expect him to consider himself to be in a state of degeneration. He expects something better and we can do something better. Quite properly we concentrate on eliminating cancer from the picture. Then we institute an intensive scrutiny of his cardiovascular and renal systems aided by many mechanical devices, including an ever-increasing multitude of electrocardiographic leads. This exhaustive examination of the heart and blood vessels, though sometimes extravagant, is justified.

In contrast, the examination of the respiratory tract is often casual; usually we are satisfied if we find no insistent symptoms and no gross radiologic signs. There is evidence to suggest that some revision of this point of view could be useful and that there are significant degrees of failure of lung function not commonly recognized. We are not in the habit of thinking of the lung as expendable and pay little attention to it except in the presence of recognizable "diseases." We are forever referring to heart failure, renal failure, and liver failure but rarely visualize the gradual process of lung failure. Reflections on this anomaly account for the cryptic title of these remarks—"Chronic Lung Failure."

Mechanically the function of the lung is more simple than that of any vital organ. Its distinctive property is that of elasticity which is the faculty by which a body regains its shape after being distorted. About half a billion times during life, in the act of inspiration, the lung is passively stretched by the descent of the diaphragm and the elevation of the ribs; half a billion times in the act of expiration, it must recoil, sucking up the slack diaphragm and pulling down the unsupported ribs. This recoil is analogous to cardiac systole and is ac-

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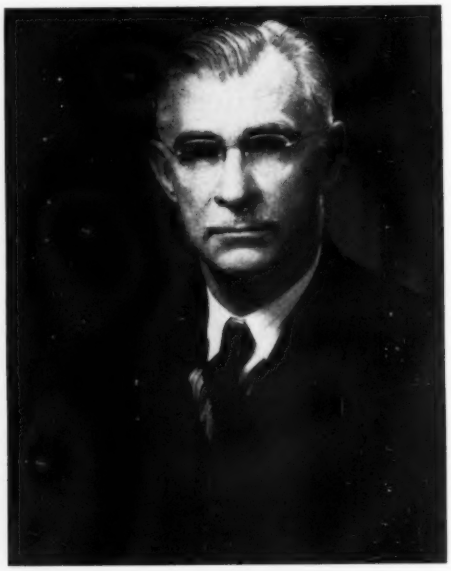

J. D. ADAMSON

complished by virtue of inherent pulmonary elasticity.

Elasticity perishes with use and years and there is no evidence that it ever regenerates. Each individual on attaining adult growth has an equipment of elastic tissue of a certain quantity and quality; when this has been worn out by use or misuse, "he has had it." As deterioration of elasticity progresses, the recoil of the lung inevitably becomes less vigorous and less complete. This failure to spring back from the position of inspiration, this failure of systole, is the essence of the commonest form of chronic lung failure. Its far advanced stage has long been recognized as chronic emphysema.

The situation in well-advanced emphysema as compared to a normal lung is illustrated in the diagram (Figure 1). "A" represents the capacity of a normal lung at full inspiration. The shaded part is the residual air after a forced expiration. The clear part represents the total vital capacity, *i.e.,* the amount of air that can be shifted from full inspiration to full expiration. This is an index of the pulmonary recoil or elasticity. "B" shows the condition in emphysema. The residual air after full expiration is much increased and the range of movement or vital capacity is correspondingly reduced. It will be seen that the total capacity of the lung is not changed. But the total amount of air in the lung while at rest is much increased and the amount of movable air is much reduced. The lung is not "blown up" or "distended" as is so often asserted. It is very little larger than it was before. It is merely unable to retract from the position of inspiration because elasticity is defective. Much of the air that it contains cannot be put into circulation; it is indeed a frozen asset.

Besides failing in retraction or recovery after distortion, a lung might lose the faculty of having its shape changed, *i.e.,* it becomes less expandable. This is produced by fibrosis. Every inflammation and every irritation of the lung initiates fibrosis. Also the passage of years sees the substitution of the vital tissues by unyielding fibrous tissues.

The effect of fibrosis on the lung, in general, has the opposite effect to that of loss of retractability. It tends to make the lung smaller rather than larger and it interferes with expansion rather than retraction. In most cases it is secondary to some other obvious condition, especially tuberculosis, repeated pyogenic invasion, silicosis, or sarcoidosis. Besides, there are cases of gradually progressive, diffuse fibrosis which appear to arise "de novo." These seem to be more common among middle-aged females.

These two prime causes of chronic lung failure, emphysema and fibrosis, commonly develop side by side. Since they have opposite physical effects on the lung, their signs sometimes tend to cancel one another. In spite of this, in any given case, one or the other tendency usually dominates the picture. We can commonly divide cases into those whose lung failure is due to emphysema and those in whom fibrosis is the chief factor. The follow-

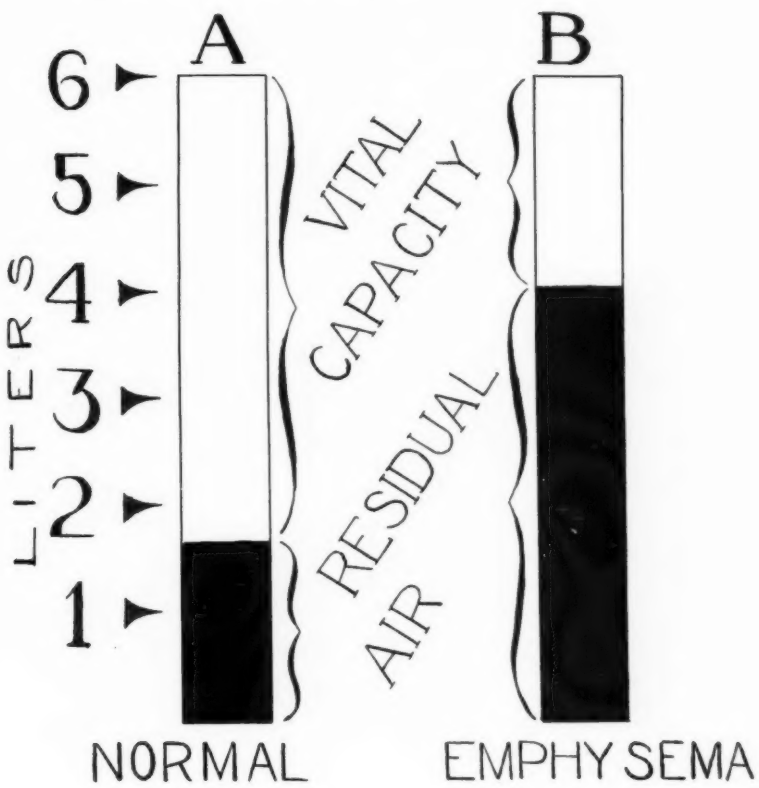


Figure 1. Situation in well-advanced emphysema as compared to a normal lung.

ing remarks will be concerned with the recognition and management of emphysema.

Clinical diagnoses, like fashions, have periods of popularity and of neglect; the history of emphysema illustrates this. Before the nineteenth century it was unknown except to a few morbid anatomists, especially Baillie and Morgagni. Laennec (1819) first established it clinically by correlating symptoms and physical signs with postmortem findings. Throughout the nineteenth century it was very much to the fore because it had such easily demonstrated physical signs. Stokes, Walshe, Rokitansky, Osler, and many other great clinicians made much of it. In our day it has definitely lost caste. The pathologists who first discovered it are still loyal and chest specialists commonly give it some thought, but clinicians in general often overlook it. This partial eclipse of an old favorite is largely a result of the influence of radiography.

In the diagnosis of pulmonary conditions signs and symptoms have, to a great extent, been superseded by x-ray findings. This is entirely justified in the search for tuberculosis, but is an unfortunate tendency so far as other pulmonary conditions are concerned. Emphysema has been particularly neglected because radiologists have been almost completely preoccupied with the discovery and interpretation of opacities. The opposite condition—increased penetrability—unless it be localized and circumscribed, has been neglected. This is partly due to the universal custom of having

chest films made in a position of full inspiration which increases the penetrability of normal lungs and so partly spoils the contrast to those that are emphysematous. Also, the translucency of emphysema is often obscured by associated conditions—especially fibrosis and pneumonitis. As a consequence, most radiologists rarely suggest the possibility of emphysema from the film alone and, indeed, most emphysematous lungs actually appear fairly normal radiologically.

THE symptoms and the signs of emphysema are readily recognized when they are far advanced. The barrel shaped chest fixed in a position of almost full inspiration; the insistent paroxysmal cough; the marked dyspnea on effort; the recurrent attacks of bronchitis, bronchospasm, or pneumonitis, and finally right heart failure are well known. But when these evidences of far advanced emphysema appear, it is too late to do much about it. The terminal event, right heart failure, is the most discouraging type of heart failure to treat; our old standby, digitalis, is usually ineffective or harmful and such things as venesection are mere acts of desperation.

When one is confronted with such a case in a patient who is very old, one may take comfort from the stern fact that man is mortal and that time alone ruthlessly and inevitably wears out elastic fibers. But when it occurs—as it does—in those under 60, one automatically asks: "Could anything have been done to prevent this disease or postpone this evil hour?" This brings up the perennial question: "What are the early symptoms and signs?"

The older writers considered that emphysema was always secondary to chronic infection or asthma, and it is, of course, true that either of these will contribute to its production. It is also true that there is emphysema which is primary, comes on insidiously, and is commonly overlooked until complicated by infection or spasm. This primary lung failure can be recognized—if thought of—before gross complications have developed.

In Manitoba we have had an excellent opportunity to study this question. In the early days of the present century we had a large immigration of peasant farmers from Galicia and Bukovina, provinces in the extreme southwest of the old Ukraine. Before and since coming to Canada they worked at the most arduous labor. Many of them are now in the sixth and seventh decades of life and for some unaccountable reason emphysema is exceedingly common among them. Our hospital wards at all times have several far advanced cases. In them the development of emphysema can frequently be traced as a primary lesion—the so-called bronchitis and asthma being quite definitely secondary.

Unfortunately, for early diagnosis, the first symptoms are so insidious in onset that the patient, over the years, adjusts himself to them and often accepts them as natural for his years.

TABLE 1

| DYSPNEA OF EMPHYSEMA | CARDIAC DYSPNEA |
|---|---|
| Very gradual onset (five to ten years) | More sudden onset (months) |
| Always worse in winter and cold air | Not necessarily so |
| Usually normal rate | Tachypnea common |
| Obvious expiratory difficulty | No special expiratory effort |
| Dyspnea apparent to observer | May be inconspicuous |
| Not very distressing | Usually accompanied by anxiety or fear |
| Not paroxysmal or unprovoked (unless asthmatic) | Spontaneous nocturnal attacks |
| No obvious cardiovascular signs | Other objective signs of cardiovascular disease |

*Dyspnea* is the cardinal symptom and emphysema cannot be diagnosed in its absence. It begins in the fourth or fifth decade and develops slowly. As a rule the patient accepts it as a sign of aging. He will often realize that his work is "too hard for his age" and will make some job adjustment. If he complains and is examined at this stage, the gradually increasing dyspnea is most frequently mistaken for cardiac dyspnea. If there is some hypertension—which is more common among em-

physematous patients than others—this inference is strengthened. If there is no hypertension, cardiac arteriosclerosis is often invoked as a cause. This may commonly be supported by minor electrocardiogram changes often interpreted as "myocardial strain." The points that differentiate these two common sources of dyspnea are brought out by a searching history. Table 1 presents the contrasting features.

None of these points is alone sufficient to distinguish these two common forms of dyspnea. By considering all of them it is usually possible to form a sound opinion as to the chief source of the dyspnea. In general, one can say that pulmonary dyspnea is objective and cardiac dyspnea is subjective. Pulmonary dyspnea is clamorous and arrests the attention of the observer; cardiac dyspnea is silent but it completely preoccupies the patient. When cases are far advanced and there is an element of right heart failure, it becomes most difficult or impossible to estimate what part of the dyspnea is from each source. In general, in such circumstances the pulmonary contribution is underestimated. Much significant emphysema may be discovered among the patients in "heart clinics" and emphysema is frequently an unexpected autopsy finding.

Bronchospasm ultimately plays a part in the dyspnea of emphysema. Many patients finally have definite paroxysms from slight provocation. In fact, it is true to say that asthmatic attacks coming on after middle life most commonly have emphysema as their main cause.

*Cough* appears with the dyspnea or soon afterwards. It may be the first symptom of which the patient takes heed. It has several distinctive features by which it may be recognized. These are: (1) much out of proportion to expectoration; (2) spasmodic and paroxysmal (paroxysms uncontrollable and produce cyanosis, dyspnea, and sometimes vomiting); (3) brought on by effort, cold air, dust, or laughter (paroxysms commonly occur on first arising); and (4) each cough prolonged and gusty—with emphasis on expiration (the opposite to whooping cough).

*Expectoration* is always scanty or absent for a long period in primary emphysema. Ultimately defective drainage is followed by chronic inflammation and more profuse expectoration and sometimes secondary bronchiectasis.

This history of insidious dyspnea associated with unproductive spasmodic cough is usually present in patients with this type of lung failure, but it is rarely given spontaneously. There is no condition in which the patient is so casual about his symptoms. His family—especially his wife—will commonly tell you much more than he will about his cough and dyspnea.

*Loss of weight* is sometimes surprising in its degree and rate.

*Fatigability* also may be one of the presenting symptoms. These two latter symptoms may occasionally be so striking as to arouse a strong suspicion of tuberculosis or malignancy in the minds of both patient and doctor. Even though the disease is essentially very slow in its progress, urgent symptoms may appear quite suddenly in some cases.

The diagnosis can be supported by definite physical signs. In far advanced cases these may be discovered on a very cursory examination. They may be enumerated as follows: (1) general undernourishment; (2) varying degrees of cyanosis; (3) thorax nearly fixed in position of inspiration; (4) reduced movements and epigastric pulsation; (5) percussion sometimes gives hyperresonance; (6) weak breath sounds, prolonged expiration, and rhonchi; and (7) myotatic irritability. Minor degrees of these signs are found in less advanced disease.

A plethora of other signs have from time to time been described. As with many other diseases, the multiplicity of alleged signs tends to make the diagnosis appear more complex than it really is. In a patient with symptoms as described, one needs to demonstrate only two to secure the diagnosis. Since the fundamental defect is loss of elasticity, the most dependable physical sign is reduction in movement of the thorax. This can best be tested by the oldest method—palpation. By standing behind the patient and placing the fingers in the intercostal

spaces one may analyze the movement. If the lung is normal one can feel the rubbery expansile thrust during deep inspiration. In emphysema this sensation of vigorous inflation disappears and the thorax feels as though paralyzed at the top of inspiration, appropriately called "frozen." This simple maneuver to test movement is better than radiography or vital capacity estimations—though these may be used for corroboration, if it is convenient.

THE second important physical change is the characteristic contour of the thorax. This change from the normal to the so-called barrel shaped chest produces a multitude of minor signs, e.g., high square shoulders, short neck, horizontal ribs, wide epigastric angle, and many others. All of them may be expressed in a simple mathematical statement, namely the "thoracic index."

As the lung loses elasticity it becomes more globular; the anteroposterior diameter becomes greater. The usual anteroposterior diameter is in the neighborhood of 20 cm. The largest anteroposterior diameter in normal people is rarely over 24 cm. Paul M. Andrus[1] believes that anything over this figure means certain enlargement. This is by no means always the case and very large people who have normal lungs may have anteroposterior diameters up to 25 cm. The transverse diameter in normal people is in the neighborhood of 30 cm.—the usual variation is from 26 to 36. The thoracic index (e.g., the anteroposterior diameter/the lateral diameter) is therefore normally about 0.7 and varies from 0.6 to 0.75. As emphysema increases the chest becomes deeper and this figure increases. Any figure over 0.75 almost certainly means emphysema. In far advanced cases the figure may be 1.0 or more; that is, the thorax is deeper than its width.

These measurements are readily made with a pair of obstetric calipers with the patient in an upright position. The largest diameter in each direction is used in determining index; care must be taken to hold the calipers horizontally. Any deformity of the chest primarily due to disease of bones renders these measurements valueless.

These two simple physical signs—reduction in movement and increase in thoracic index—are the most dependable evidences of beginning lung failure. Their discovery in elderly or middle-aged people can give a most valuable clue to the explanation of beginning deterioration. They will indicate the true cause of much dyspnea, now vaguely attributed to "myocarditis" or cardiac arteriosclerosis.

Unfortunately most chronic lung failure that we see is already far advanced when diagnosed. Patients too often complain only after the inevitable complications have made life unbearable and treatment must usually be directed against these complications and not against the primary disease. The treatment of these complications—namely, bronchospasm, gross sepsis, and right heart failure—is purely palliative and will not be considered here.

By being on the alert for the characteristic symptoms and the beginning signs, especially increased thoracic index, one is sometimes able to make an early diagnosis. What should be the management of such a case? Is there anything substantial to be done to postpone complete disability?

In thinking of the preservation of lung elasticity it is helpful to make an analogy to the elasticity of an inner tube. The length of its life depends on: (1) the quality of the material originally put into its composition, (2) the amount of actual trauma that it has suffered, and (3) the variations in pressure to which it has been subjected.

The survival of lung elasticity depends on precisely the same circumstances.

1. The quality of the elasticity with which lungs are endowed at birth varies widely between individuals, families, and possibly races. In practice there is not much one can do about this except to recognize these tendencies and take special precautions. For example, in the Galicians to whom I have referred, the first possibility when one of them begins to fade

[1] ANDRUS, PAUL M.: J. Canad. M. Services 3:6 (September) 1946.

out is always lung failure. Similar tendencies have long been recognized in some families. The discovery of such cases in the incipient stage demands a complete investigation of the patient's activities in the hope of eliminating lung stress. This may mean a complete change of occupation or the renunciation of futile physical efforts at "keeping young."

2. All trauma to the lung hastens deterioration just as blowouts finish a tire tube. Trauma comes in the form of repeated inflammation. With the universal use of the newer drugs there is no doubt that secondary lung failure due to smoldering infection will be much reduced. A wider use of these drugs in subacute and chronic pulmonary inflammations would contribute to the prevention of lung failure.

3. In emphysema that begins without such provocation (apparently primary) can we do anything to prolong elasticity? Can we reduce the frequency and violence of sudden changes of intrapulmonary pressure? This is caused naturally by hard manual labor which involves straining with the glottis closed. It accounts for the fact that most emphysema is found in laboring males. Medically we can do no more about this than we can prevent deterioration in the tire tubes of trucks that must carry heavy loads. Industrially it seems to be solving itself since hard manual labor is fast becoming quite out of fashion.

THERE is one thing I think we can do. That is reduce the amount of useless coughing. Frequently abnormal coughing is to the lung what a rough road is to a tire. A great number of people accept a morning and evening paroxysm of coughing as normal. It is so common in practice that we, too, are inclined to minimize it if we find none of the well-known pathologic conditions. In the presence of cough these should be sought for by every means at our disposal, including radiology, bronchograms, bronchoscopic examinations, and particularly a searching examination of the upper respiratory tract. Also allergy should be considered. In the absence of these, the commonest cause is cigarettes. I am convinced that anyone with an otherwise unexplained cough should immediately give up cigarettes. If, besides coughing, they are beginning to have slight dyspnea and signs suggesting emphysema, it is imperative—just as important as for the man with angina or peripheral vascular disease. The results in chronic cough are usually most striking—though it may require several weeks of abstinence to show them.

## SUMMARY

1. Chronic lung failure is common in those past middle life.

2. It is due to fibrosis, which is secondary to chronic inflammation or to deterioration of elasticity (emphysema).

3. Emphysema is frequently a primary condition and not necessarily secondary to infection or asthma.

4. It is usually recognized after secondary infection, bronchospasm, and right heart failure have produced total disability.

5. It may be recognized early by a detailed history of symptoms and by discovery of reduced movement and increased thoracic index.

6. If recognized early, its progress might be retarded by taking precautions against "wear and tear" on the elastic tissue of the lung.

DIAGNOSTIC CLINIC

# The Medical Management of Hyperthyroidism

DANIEL L. SEXTON*

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THE MEDICAL management of hyperthyroidism includes that group of patients treated wholly without surgery and those patients who ultimately have surgery but require careful preparation. Agents available for treatment of this disease include the goitrogenic drugs, the iodides, x-ray, and radioactive iodine.

X-ray has been used for many years by direct application to the gland without very encouraging results. However, it may be considered as a method of treatment when other measures fail in the very difficult cases. There have been very few permanent remissions reported following the use of x-ray directly to the gland.

Another form of x-ray therapy is its application to the hypophysis. Thompson has reported that in a series of 43 patients there were remissions in about two-thirds. The mechanism by which this works is the suppression of the thyrotropic fraction of the anterior hypophysis. We have used it in a few instances where there has been that so-called persistent type of hyperthyroidism, with symptoms persisting after surgery, in which both iodides and the goitrogenic drugs have failed. We have applied x-ray to the hypophysis, but not with very encouraging results.

Radioactive iodine is still in the experimental stage. Although prepared by Fermi in 1934, it was clinically used for the first time in 1942 by Hamilton and Lawrence, who reported its use in three cases. In 1942, Chapman and Evans reported that in a series of 22 patients they had favorable results after one dose in 14 and less favorable results in the other 8. There were some complications from the use of radioactive iodine. Myxedema occurred in four patients; they had evidence of radiation sickness in six; and there was fibrosis of the gland in two in which the gland was biopsied.

Radioactive iodine promises a great deal. It is a nice form of treatment for the patient, for it is given in a single dose, but until its full effect is determined its use must remain in the hands of those investigators who have proper facilities. Its effects on the other structures of the endocrine system and its effects on the organism as a whole are as yet not fully understood, so for the present it must be carefully controlled; we must keep abreast of developments, for the results as reported to date are indeed very promising.

This leaves us, then, the use of the goitrogenic drugs and the iodides, which I believe

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are of the greatest practical importance. Since the advent of the goitrogenic drugs there has been a revived and a keener interest in the medical management of hyperthyroidism. This is due to the fact that surgery has not fulfilled all the requirements necessary for the adequate treatment of this disease. Arguments that surgery completely cures exophthalmic goiter may go on, but many of us who practice the medical side of medicine know that there are many problems following surgery with which the surgeon never is troubled. He often does not see the patient after the latter leaves the hospital. There are many problems in the management of hyperthyroidism that have not been solved by thyroidectomy.

Chemical compounds that possess antithyroid properties fall into two general categories: (1) those that act without producing goiter, such as iodine and radioactive iodine; and (2) those that produce hyperplasia of the gland and at the same time suppress thyroid function. These latter drugs are referred to as goitrogens, and include the cyanides, thiocyanates, sulfonamides, thiourea, and derivatives of thiourea. The antithyroid and goitrogenic effects of cyanides and thiocyanates are of experimental interest but not of great clinical significance. Experimental work on the cyanides, however, laid the groundwork for the development of a great deal of the present knowledge of the physiology of thiourea derivatives.

In 1942 Kennedy determined that the active principle which caused goiter in cabbage-fed rats was thiourea, or allyl thiourea. With this information, Astwood studied a large number of compounds, variations of thiourea, and concluded that thiouracil was the most effective derivative at that time. Since Astwood's original work on the use of thiouracil in man, several thousand hyperthyroid patients have been treated and observed.

The toxicity of thiouracil limited its widespread use. Continuing his search, Astwood and his co-workers isolated 6-propyl thiouracil, which has been found to be effective in dosages of 30 to 50 per cent that of thiouracil. At the present time propyl thiouracil is the drug of choice when this form of therapy is employed.

DANIEL L. SEXTON

THE TWO figures give some idea of the effects of thiouracil. I think that Figure 1 is self-explanatory. In the upper left corner is a diagram of normal thyroid relationships, the pituitary-thyroid relationship. Normally there is stimulation from the emotional centers of the brain. The cause of exophthalmic goiter or Graves' disease is not fully understood, but it is believed to be due to a severe emotional upset. If we assume that these emotional stimuli arise within the brain, they then come down to the pituitary and stimulate that gland. On your left of the two-armed arrow is that stimulating portion that causes growth of the gland; on your right is the arm that affects the uptake of iodine and the ultimate formation of the thyroid globulin.

The thyroid globulin is composed of several elements: diiodotyrosine, thyroxine, and other amino acids. Unless the globulin contains thy-

roxine, the other elements do not have the effect that we normally think of as the thyroid-stimulating effect.

In the arm to your right you see that the thyroid hormone, designated as TH, is formed. It has an inhibitory effect on the pituitary and on the production of the thyrotropic fraction; it also has an inhibitory regulatory effect on the amount of thyroid globulin that is formed. With this fine mechanism in proper relationship, there is just the exact amount of thyroid hormone formed to keep the body metabolism normal. That relationship is designated by the effect on the body tissues, the BMR, which is representative of normal thyroid function.

If we look at the diagram on hyperthyroidism we see an increased stimulation from the emotional centers coming down to the hypophysis. This increased stimulation reflects in an increased production of the thyrotropic hormone, which in turn affects the gland proper and produces further hyperplasia. As a result, the thyroid gland is larger than it is under normal circumstances.

The right arm causes an increased uptake of iodine from the blood. With this increased uptake of iodine there is an increased formation of the thyroid hormone. This increased formation of the thyroid hormone makes an attempt to regulate the production of thyrotropic hormone, but its attempt is inadequate, and this increased stimulation continues. It also attempts to go around and regulate the amount of thyroid hormone that is formed, but again it cannot overcome the excess stimulation from the thyrotropic fraction. This process results in an increased metabolism in the body tissues, which shows up in an increased metabolic rate.

The lower diagram indicates what happens when the thiourea derivatives, thiouracil or propyl thiouracil, are employed. The amount of stimulation from the hypophysis is the same as it was in hyperthyroidism. The thyrotropic fraction which has had this increased stimulation comes down and increases further the hyperplasia of the gland. That is true theoretically, and practically it is true in about half the instances in which thiouracil or propyl thiouracil is used. The gland enlarges probably in half the instances; in just as many it does not enlarge, or may even become smaller.

The thiouracil effect, however, is chiefly on the right arm. It blocks out the formation of the thyroid hormone within the gland proper. There is an enzyme system that is necessary for the production of the thyroid hormone, and when this block is placed within the gland proper there is a reduced uptake of iodine from the blood, i.e., there is a blocking out of the formation of the thyroid hormone. When this occurs, the original inhibitory effect as shown in the first diagram is lost. As a result, the pituitary stimulation goes on uninhibited, the thyroid hormone is not formed, and the basal metabolic rate drops very low.

THE indications for thiouracil therapy are (1) preparation of the patient for surgery (more will be said about that later), and (2) the nonsurgical treatment of hyperthyroidism.

There have been very few reports on permanent remissions with propyl thiouracil, mainly because the drug has not been used for an adequate length of time. With thiouracil, however, the drug was used and withdrawn and in some quarters permanent remissions were reported in about 50 per cent. That was not our experience with thiouracil. Before using propyl thiouracil we used thiouracil in 44 patients and we thought we had a good many permanent remissions. As time went on, however, these patients would come back to us either with a spontaneous recurrence or with a recurrence following some other systemic disease, many times after an upper respiratory infection. Thus we believe that permanent remissions following the use of thiouracil will prove to be relatively few.

Propyl thiouracil has been used now for about eighteen months, and we feel that we have not used it long enough to make any report. However, in those instances where the patient has dropped out of sight for a period of time and then returned, or when, for some reason, the drug had to be withdrawn, there

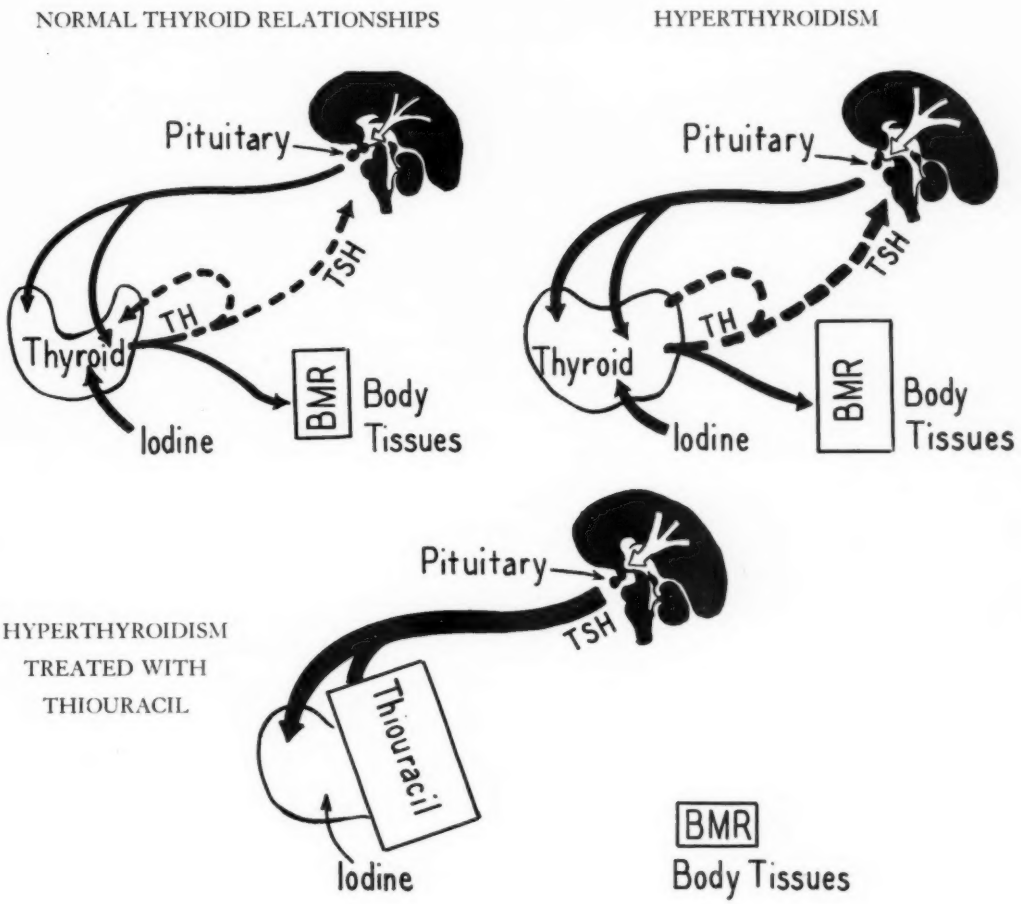


Figure 1. Suggested pituitary-thyroid relationship in normal, hyperthyroid, and thiouracil (or propyl thiouracil) treated patients.

has been a recurrence of symptoms, but those patients were not given the treatment over a prolonged time. We have felt that we ought to carry this treatment out for at least eighteen months, and we are now just beginning to take our earlier patients off the drug.

Recurrent hyperthyroidism is oftentimes an instance where thiouracil or propyl thiouracil is to be employed for reasons which I am sure are well understood: the patient does not desire further surgery, is disappointed, and fears a recurrence, so if we can control him we feel that he is entitled to that plan of treatment.

We feel definitely that the treatment of hyperthyroidism of pregnancy should be carried out medically if it is at all possible. As you know, that is quite a problem with the iodides.

Agoitrous hyperthyroidism is a form in

which propyl thiouracil may be employed. It is valuable since there is always some question as to the diagnosis in these cases. The proof comes in the response of the patient.

Finally, as a therapeutic test it is valuable in those unusual cases that offer a great deal of trouble diagnostically as to whether the patient is of the anxiety type with an acute emotional upset or whether the patient is truly hyperthyroid.

Because of toxic reactions from this drug we should proceed in its use if not with extreme caution, certainly with careful observation. Thiouracil was toxic to the extent of about 14 per cent. The most serious reaction that came from thiouracil was, of course, leukopenia, which was less than 1 per cent, but there were other reactions that totaled about 14 per cent. The reactions that did occur with thiouracil and that can occur with propyl thiouracil are leukopenia and eventually agranulocytosis (there were cases of agranulocytosis and death with thiouracil), jaundice, purpura, fever, urticaria, morbilliform rash, edema, diarrhea, submaxillary and parotid involvement, and alopecia areata.

The propyl thiouracil reports indicate that toxicity measures about 6 per cent in the dosages that are employed, which are up to 300 mg. a day, so it is a much less toxic drug. At this time it is the drug of choice.

I do not want to imply that the iodides are not still of great value, for they are; they play an important part in the treatment of hyperthyroidism. If a patient is being prepared for surgery and is in a mild state of toxicity, the iodides—some form of iodine—are the drugs of choice, because the patient can be prepared in a relatively short time. Propyl thiouracil, on the other hand, requires some six to eight weeks for preparation.

THE patient, however, who is profoundly hyperthyroid had best be prepared with propyl thiouracil because the basal rate can be brought down to a much lower level—down to normal and below normal—if the dosage is increased and carried out over a sufficient period of time; and it definitely reduces the incidence of thyroid storm. Lahey reports that they have had no thyroid storms in a large series of cases since the thiourea derivatives have been employed.

If a patient is prepared with propyl thiouracil, iodine should be added from two to four weeks before the operation. By so doing, the hypervascularity and the hyperplasia, the friability of the gland that results from the use of this drug, are overcome.

Iodine may be used in the treatment of hyperthyroidism when the patient is intolerant to propyl thiouracil, and shows reactions to it. In the treatment of thyroid crises iodides may prove lifesaving.

The following cases have been treated chiefly with propyl thiouracil.

The first case is that of an adolescent boy, with a diffuse enlargement of his gland. This 10-year-old boy had been coming to the pediatric clinic at Desloge Hospital since birth. Because of the exophthalmos and the enlarged gland, Graves' disease has been suspected right along. He would come in, however, only for other disorders, and the diagnosis was never fully established though attempts were made to get a basal and to study him carefully. However, he came to the endocrine clinic in May 1947. The result of several basal rates was +27 per cent, and the pulse rate was 120. At that time he weighed 53 pounds. He was placed on propyl thiouracil, 50 mg. daily for the first week or two, and then the dosage was stepped up to 100 mg. daily and has been maintained right along. On October 10, 1947, his basal rate was —22, pulse rate 82 to 92, and his weight 63 pounds.

The boy is much calmer; his school work, of course, has improved because he can now pay attention, and he has shown the improvement that would be expected with a basal rate of —22.

This boy is not hypothyroid with a basal of —22. That basal is probably normal for him, and for that reason the +27 was not indicative of the severity of his thyrotoxicosis.

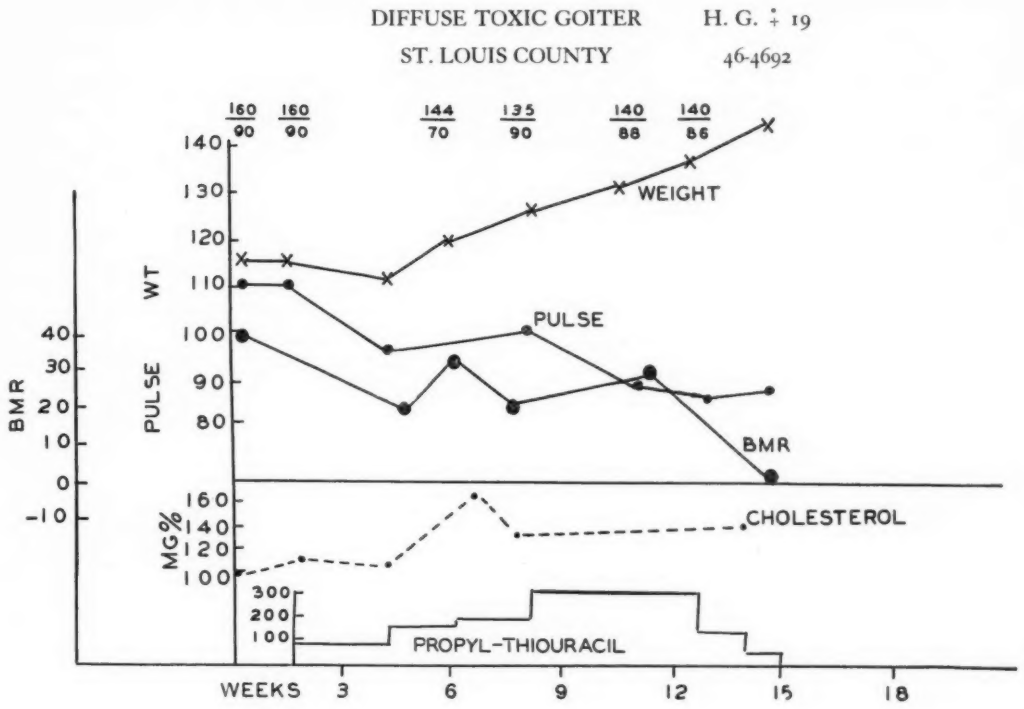


Figure 2. Diffuse toxic goiter in 19-year-old girl who showed maximum response to treatment after thirteen weeks.

*(Observed on the medical service of Dr. J. P. Murphy.)*

We think that adolescent children should be carried through their adolescence on medical treatment. The thyroid gland plays a very important part in the control of the endocrine system, and during the period of adolescent awakening, the growth and development of the child and his emotional stability will be much better controlled if it can be left intact.

In the second case, the patient, a female 47 years old, shows a small nodule in the right lobe. This lady came to us in July 1947 with a history of having lost 25 pounds over a three months' period and of being extremely nervous. She had a slight tremor, but none now.

Her basal rate in July was +51 per cent. She has been on propyl thiouracil since that time (a total of forty-eight days) and on October 6, 1947, the basal rate was —10 per cent. She has gained 6 pounds. Of course she has an improvement of her symptoms, as designated by the basal metabolic rate.

Oftentimes the weight gain that you would expect is lacking. When propyl thiouracil is used, the basal rate is suppressed rather definitely in the exophthalmic type in about six to eight weeks on the average. In the adenomatous type, a little longer period is necessary before adequate results are obtained.

THE THIRD patient is a lady who entered St. Louis City Hospital in March 1947. She is 64 years of age. She had been treated on the outside for cardiac disease and was sent in with the thought that her illness was due to a cardiac break. When she entered the hospital in March she was semi-conscious, extremely restless, and her tracing showed auricular fibrillation. The blood pressure at that time was 160/50. As she was examined and studied, she was found to have prominence of her eyes and a definite enlargement of her thyroid gland. It was felt that her trouble was not solely that of cardiac decompensation but that she had thyrotoxic crisis.

She was given iodides intravenously (sodium iodide and glucose). She showed some improvement on the second day, although she says that she does not remember the first five days in the hospital. It was about the fifth day when we felt that she was going to get along all right.

The iodides were continued on this patient. On the ninth day a basal determination was made, and it was +48 per cent. Iodine was continued for a period of three weeks, then discontinued, and propyl thiouracil was instituted. She has been on propyl thiouracil since about the first of April.

She went home, came back to the outpatient clinic, was carried along on treatment, and early in September it was decided that surgery would be the best plan of treatment for this lady. She has continued to show fibrillation. She takes 2 cat units of digitalis daily. Since March she has gained 30 pounds in weight. Her basal rate within the past week was +11 per cent, her blood pressure is 138/85. She is up and around and we feel that she is ready for surgery. She has had iodine the past three to four weeks and we do not anticipate any thyroid storm. We anticipate a perfectly normal, uneventful operation, such as has been our experience in those patients that have been operated after treatment.

Figure 2 graphically shows the effect propyl thiouracil had on a 19-year-old girl who was first treated with Lugol's solution. When she was first seen she had a basal rate of +37 per cent, the pulse rate was 132. She was treated with Lugol's solution for about ten weeks. They were dissatisfied with the benefits obtained and the patient dropped out of sight, but came back to this physician some sixteen weeks later, when she was referred to us. At that time her basal rate was +65 per cent, her weight was 120, and her pulse rate was up around 160.

She was placed on thiouracil and the dosage built up to 0.6 gm. per day. You can see the drop in her basal rate. It took about sixteen weeks for this girl to come down to normal, and with thiouracil she was suppressed to —26.

We have not been able to suppress the basals on our patients as profoundly with propyl thiouracil as with thiouracil. It is because of the dosage. We use 200 to 300 mg. a day of propyl thiouracil as our average dose, though there are instances when it will have to be stepped up to 400 or even 450 mg. grams to obtain the proper results.

CORRECTION

In the article, "Bacteriologic, Etiologic, and Serologic Studies in Epilepsy and Schizophrenia, III," published in the May issue of *Postgraduate Medicine*, the legends for Figures 3 (p. 374) and 4 (p. 376) were transposed.

# Congenital Anomalies of the Heart and Great Vessels

## *Clinicopathologic Study of 132 Cases*

Part I

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T. J. Dry · J. E. Edwards · R. L. Parker
H. B. Burchell · H. M. Rogers
and
A. H. Bulbulian

MAYO CLINIC
ROCHESTER, MINNESOTA

# AUTHORS' FOREWORD

THE GREATEST advances in the recognition of congenital cardiac defects have been made through the correlation of clinical and laboratory data with the findings at necropsy. It was with this thought in mind that the authors of this publication re-examined all the specimens of congenital cardiac anomalies which had been collected in the Section on Pathologic Anatomy of the Mayo Clinic over a period of some twenty-five years. From this study an exhibit was prepared, the purpose of which was to portray by models, photographs and drawings the structure of these specimens and to correlate the clinical features with the anatomic lesions. In preparing our exhibit we chose for presentation representative cases about which we had the most complete information. As is well known, a certain physiologic derangement which will produce cyanosis can be caused by a variety of anatomic anomalies. Also, there may be great variation in the symptoms and signs of patients who have a given type of cardiac malformation and, therefore, we have listed, with each case presented, the more common clinical features of that particular anomaly.

The exhibit thus prepared was presented at the centennial meeting of the American Medical Association held in Atlantic City in June, 1947. To the original data included in this exhibit we have added reproductions of portraits of pioneer investigators in the field of congenital heart disease. We selected those whose writings have greatly influenced our ideas; other students of congenital heart disease might have chosen differently. Moreover, it is not our intention to convey the impression that the influence exerted by any one of these individuals is necessarily limited to the lesion with which his or her portrait is associated.

We have studied additional cases which have since become available to us and we have modified our data in respect to the incidence of the various types of anomalies accordingly. Apart from these additions and changes, the material presented here is essentially that included in the original exhibit.

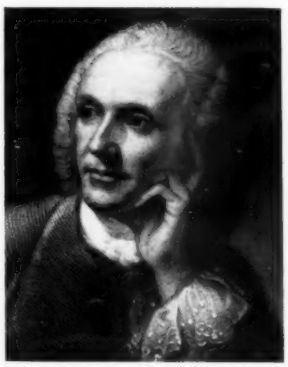
This material is being presented in *Postgraduate Medicine* in two sections, the first of which appears herewith. The second and concluding part will be published in the October issue of the Journal.

It should be pointed out that in some of the cases there was more than one primary defect of the heart or great vessels. Such cases have been listed under the heading of the most serious type of defect present. The incidence of atrial septal defect and of Eisenmenger's complex may be clarified by this further definition. We included under the heading of "atrial septal defect" only those cases in which the abnormality gave rise to signs, clinical or morphologic, of increased cardiac load. Under the heading of "Eisenmenger's complex" we included those cases in which the aorta straddled the ventricular septal defect to any degree and in which there was associated right ventricular hypertrophy and a pulmonary artery of normal or greater than normal width.

It is with much pleasure that we express our indebtedness to those who have been of assistance to us in the preparation of both the exhibit and this publication. Dr. J. W. Kernohan, head of the Section on Pathologic Anatomy, was responsible for the suggestion that the study, of which this is a report, be done. Mr. Russell Drake was especially helpful in preparing schematic drawings; members of the Photographic Department of the Mayo Clinic were painstaking in their efforts to obtain the best possible photographic representation of our material. We are indebted to the W. B. Saunders Company for permission to republish portraits of Thomas B. Peacock, William Harvey, Jean-Baptiste de Senac, Franklin Paine Mall, James Hope, Etienne-Louis Arthur Fallot, and John Baptist Morgagni; to the executors of Maude Abbott's estate to republish portraits of Maude Abbott and Karl Rokitansky and to Mr. Thomas E. Keys, librarian, of the Mayo Clinic, for his efforts in procuring photographs of some of the historical figures which we have reproduced in this publication.

# Cor Biloculare

(*Two-chambered Heart*)



WILLIAM HUNTER

*1718-1793*

In a report of three cases (Med. Observations and Enquiries, 1784), William Hunter described pulmonary atresia and pulmonary stenosis associated with ventricular septal defect. His emphasis upon the inadequacy of pulmonary blood flow in determination of the extent of the disability is modern. His clear description of the attacks of unconsciousness associated with dyspnea and cyanosis may be called a classic.

233

# Cor Biloculare

(*Two-chambered Heart*)

THIS is the most primitive heart in our series. It has a single atrium, a single ventricle and a common atrioventricular valve. A single functioning arterial trunk, the aorta, leaves the common ventricle.

The pulmonary artery lies behind the aorta and is atretic. The circulation to the lungs is by way of a patent ductus arteriosus.

The common atrium receives blood from the lungs through the pulmonary veins, and peripheral blood through the inferior vena cava and a right, as well as a persistent left superior vena cava. This anomaly frequently is associated with isolated dextrocardia.

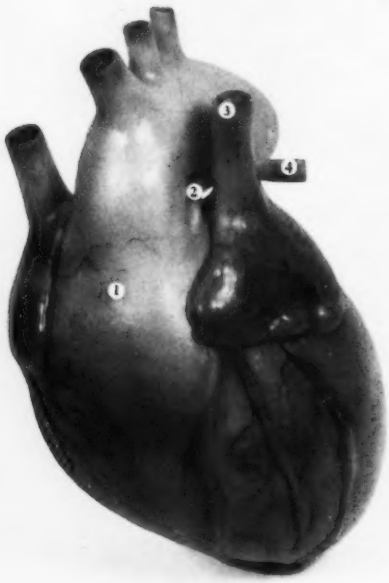



*Fig. 1*—Left anterior view (model x1).
(1) Aorta arising from common ventricle. (2) Atretic pulmonary artery. (3) Persistent left superior vena cava. (4) Left pulmonary artery.

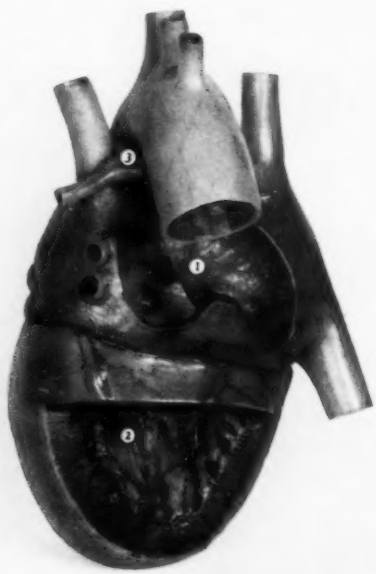



*Fig. 2*—Left posterior view (model x1).
(1) Rudimentary septum in common atrium. (2) Interior of common ventricle. (3) Patent ductus arteriosus.

## History of the Patient

FEMALE, 8 months old. History of cyanosis, since birth, on feeding or crying. No murmurs. Hemoglobin 20.7 gm. per 100 cc. of blood. Admitted to hospital for repair of diaphragmatic hernia. Roentgenogram of thorax showed diaphragmatic hernia and prominence of right upper border of the heart. Cyanosis increased postoperatively; the patient died later the same day.

## Principal Clinical Features of this Anomaly

1. Early and progressive cyanosis.
2. Characteristically, no murmurs.
3. Early cardiac enlargement of globular shape.
4. Usually, death in infancy or early childhood.

**Incidence in this Series**—One patient, aged 8 months.

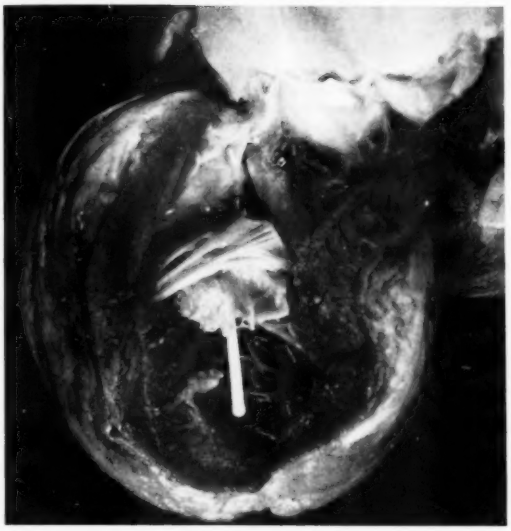


*Fig. 3*—Specimen from which model shown in figures 1 and 2 were prepared. Interior of common ventricle and aortic orifice.

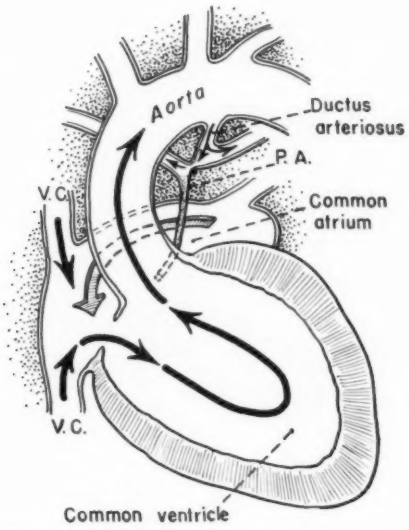



*Fig. 4*—Diagram of intracardiac circulation in cor biloculare with atretic pulmonary artery and patent ductus arteriosus.

*Fig. 5*—Thoracic roentgenogram of the patient whose heart is illustrated in figures 1, 2, 3 and 4.

237

# Cor Triloculare Biatriatum

(*Three-chambered Heart*)

### Thomas Bevill Peacock

*1812-1882*

Among the various small yet very comprehensive monographs published near the middle of the nineteenth century, that of Peacock is probably best known. The clinical and pathological correlations and the very clear illustrations are probably the best and most nearly accurate up to that time. In particular, the illustrations of the anomaly now called the tetralogy of Fallot are beautifully presented.

# Cor Triloculare Biatriatum

(*Three-chambered Heart*)

THIS is a three-chambered heart with two atria and a single ventricle. The latter represents a primitive state in which there is no ventricular septum. There is transposition of the aorta and pulmonary artery, as shown by the right anterior position of the aortic origin. In this specimen, there is isolated dextrocardia.
Functionally, this heart varies little from a two-chambered heart, since there is a free mixture of venous and aerated blood in the common ventricle.

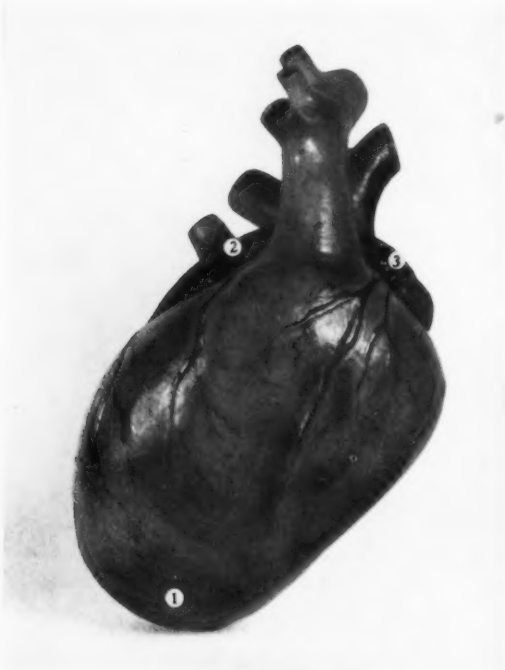


*Fig.* 6—(*left*). Anterior view (model x1). (1) Apex of common ventricle directed to the right. (2) Right atrium. (3) Left atrium.
*Fig.* 7—(*right*). Interior of common ventricle (model x1). (1) Common ventricle. (2) Aorta arising anteriorly. (3) Pulmonary artery arising posteriorly.

## History of the Patient

FEMALE, 10 months old, well until age of 5 months. Then a "cold" developed with fever and respiratory difficulty. At 7 months, cyanosis was noted which became more intense at 9 months. Patient was admitted with pneumonia and congestive heart failure. Roentgenologic study revealed isolated dextrocardia with marked cardiac enlargement. Hemoglobin, 17.5 gm. per 100 cc. of blood; erythrocytes numbered 5,710,000 per cubic millimeter. Cyanosis increased markedly before death.

## Principal Clinical Features of this Anomaly

1. Cyanosis develops early, but may be mild or transient and intensified by activity. The oxygen saturation of arterial hemoglobin always is subnormal. 2. Systolic murmur over the entire precordium usually is present. 3. Oxygen saturation of hemoglobin in ventricular blood exceeds that of hemoglobin in mixed venous blood (cardiac catheterization). 4. Roentgenologic aspects: unusual globular configuration (the most frequent anomaly associated with isolated dextrocardia). 5. Electrocardiogram: usually high voltage diphasic QRS complexes.

**Incidence in this Series**—Five cases.

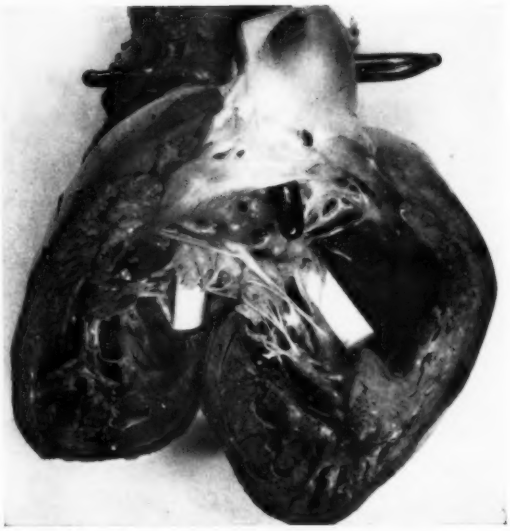


*Fig.* 8—Specimen from which models shown in figures 6 and 7 were prepared. Interior of common ventricle and origin of aorta.

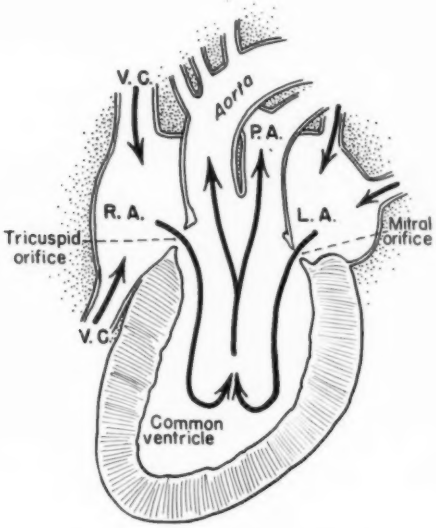



*Fig.* 9—Diagram of intracardiac circulation in cor triloculare biatriatum.

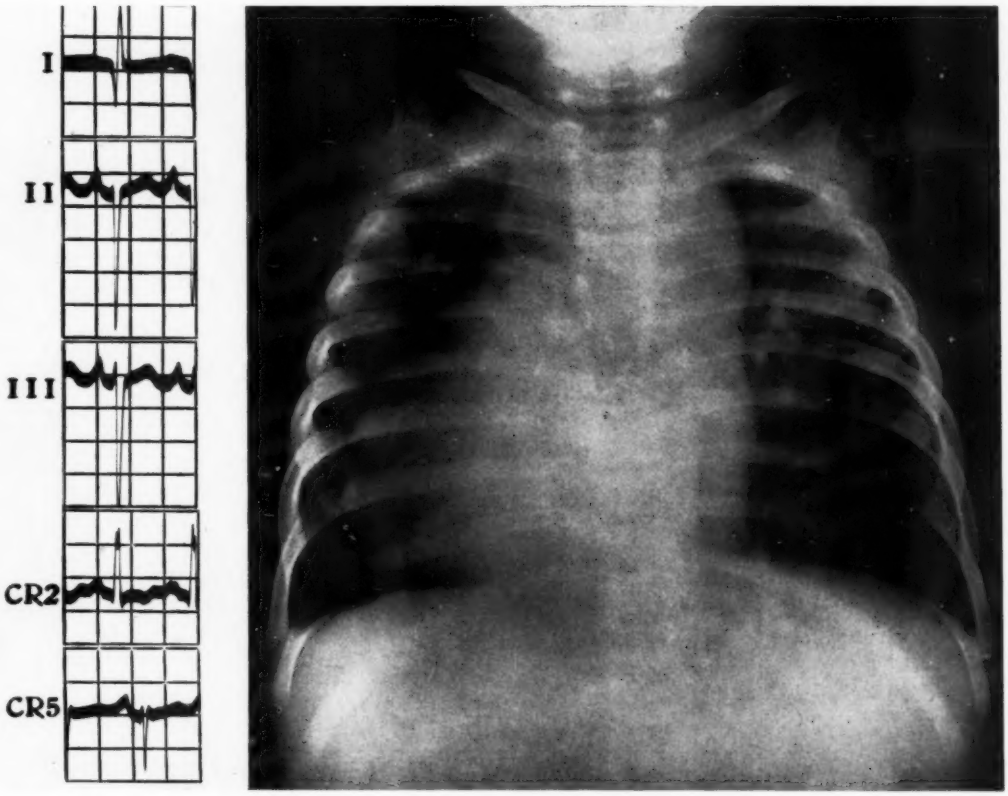
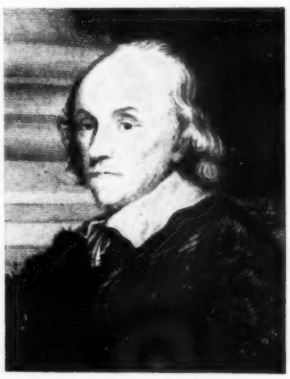



*Fig. 10*—Electrocardiogram and thoracic roentgenogram of patient whose heart is illustrated in figures 6, 7, 8 and 9.

# Atresia of Tricuspid Orifice

(*Functional Two-chambered Heart*)



WILLIAM HARVEY

*1578-1657*

On page 46 of "Exercitatio anatomica de motu cordis et sanguinis in animalibus," 1628, appears such a clear description of the fetal circulation and the flow of blood through the foramen ovale that a student of congenital heart disease should have this classic work as required reading. "So, in embryo forms, whilst the lungs are idle and have no action or motion (as if there were none at all) nature makes use of both ventricles of the heart, as if one, for transmission of blood."

# Atresia of Tricuspid Orifice

*(Functional Two-chambered Heart)*

IN THIS heart there is no communication between the right atrium and the right ventricle. The foramen ovale is patent.

The right ventricle is diminutive and communicates with the large left ventricle through a slit-like defect in the ectopic ventricular septum. The pulmonary artery is narrower than the aorta. The ductus arteriosus is closed.

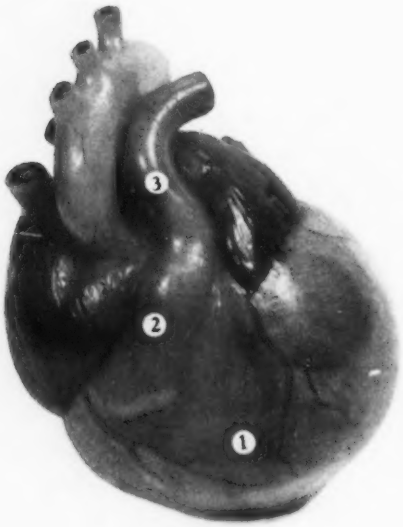



*Fig. 11*—Anterior view (model x1).
(1) Large left ventricle. (2) Diminutive right ventricle.
(3) Pulmonary artery.

*Fig. 12*—Interior viewed from right (model x1).
(1) Patent foramen ovale, the only outlet of right atrium.
(2) Large left ventricle. (3) Diminutive right ventricle.
Probe is inserted through ventricular septal defect.

## History of the Patient

FEMALE, 4 months old, had transient cyanosis at birth, more apparent at 5 weeks of age. Basal systolic murmur. Readmitted at 10 weeks of age. Same murmur present; moderate cyanosis; hemoglobin 17.7 gm. per 100 cc. of blood; erythrocytes, 5,170,000 per cubic millimeter. Roentgenogram: globular enlargement with absence of shadow of pulmonary conus and diminished hilar markings. Electrocardiogram: left axis deviation. At 4 months, right hemiplegia developed. Patient readmitted in coma and died. Thrombosis of longitudinal and transverse venous sinuses, with left cerebral infarction.

## Principal Clinical Features of this Anomaly

1. Progressive cyanosis from birth.
2. Severe spontaneous dyspneic attacks have been noted in some cases.
3. Usually, basal systolic murmur.
4. Roentgenologically, cardiac enlargement. Configuration may resemble that in tetralogy of Fallot.
5. Electrocardiogram: left axis deviation, an important diagnostic feature.

**Incidence in this Series**—One patient, aged 4 months.

*Fig. 13*—Specimen from which models shown in figures 11 and 12 were prepared. Interior of right atrium.

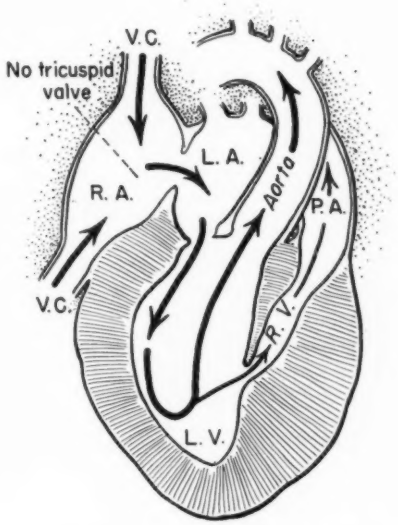



*Fig. 14*—Diagram of intracardiac circulation in atresia of tricuspid orifice.

*Fig. 15*—Electrocardiogram and thoracic roentgenogram of the patient whose heart is illustrated in figures 11, 12, 13 and 14.

# Atresia of Mitral Orifice

(*Functional Two-chambered Heart*)

JEAN-BAPTISTE DE SÉNAC

*1693-1770*

In de Sénac's detailed clinicopathologic studies of diseases of the heart, "Traité de la structure du cœur, de son action, et de ses maladies," there appears a thorough discussion of the fetal circulation and a short discussion of the congenital anatomic defects of the heart. De Sénac has been credited (Abbott) with having first associated la maladie bleue with absence of the ventricular septum.

# Atresia of Mitral Orifice

(*Functional Two-chambered Heart*)

IN THIS heart there is no communication between the left atrium and left ventricle. The foramen ovale is patent.

The left ventricle is small and communicates with the larger right ventricle through a defect in the membranous portion of the ventricular septum.

The aorta arises anteriorly and to the left, and is slightly narrower than the pulmonary artery. The ductus arteriosus is closed.

*Fig. 16*—Left lateral view (model x1).
(1) Atresia of mitral orifice. (2) Patent foramen ovale.
(3) Large right atrium. (4) Small left ventricle.

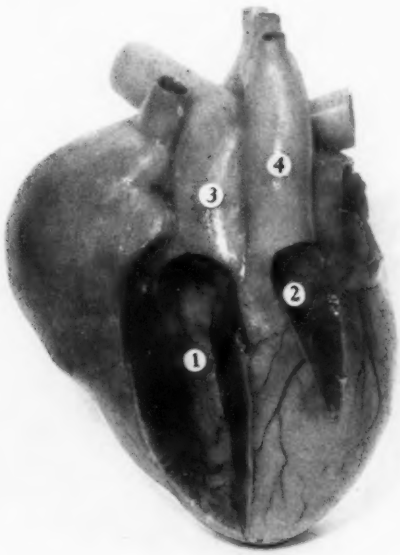



*Fig. 17*—Anterior view (model x1).
(1) Large right ventricle. (2) Small left ventricle.
(3) Pulmonary artery. (4) Aorta.

## History of the Patient

MALE, 4 months old. Loud systolic murmur noted at birth. Slight intermittent cyanosis, beginning at 2 months of age. Child represented a feeding problem, with poor development. On final admission, loud systolic murmur and thrill were noted over entire precordium and interscapular area. Roentgenogram showed marked cardiac enlargement; the electrocardiogram, right axis deviation. Severe terminal cyanosis with pneumonia occurred.

## Principal Clinical Features of this Anomaly

1. Progressive cyanosis.
2. Precordial systolic murmur.
3. Death in infancy or early childhood.
4. Roentgenologic aspects: marked right ventricular enlargement and prominent shadow of pulmonary artery.
5. Electrocardiogram: right axis deviation.

**Incidence in this Series**—Three patients: one newborn, one 3 months old and one 4 months old.

*Fig. 18*—Specimen from which models shown in figures 16 and 17 were prepared. Interior of left atrium.

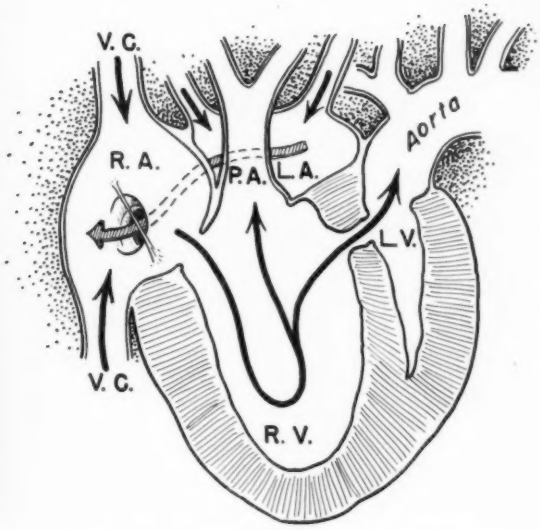



*Fig. 19*—Diagram of intracardiac circulation in atresia of mitral orifice.

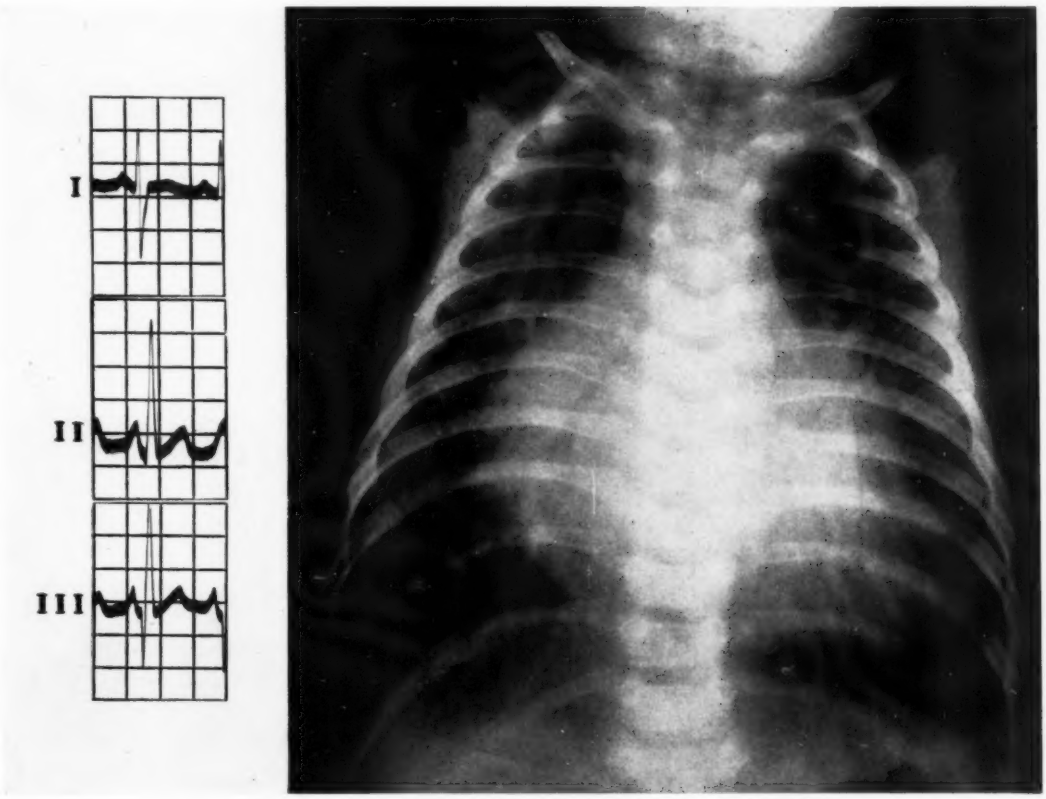



*Fig. 20*—Electrocardiogram and thoracic roentgenogram of the patient whose heart is illustrated in figures 16, 17, 18 and 19.

# Persistent Common Atrioventricular Canal

FRANKLIN PAINE MALL

*1862-1917*

Franklin Paine Mall, professor of anatomy in the Johns Hopkins University Medical School of Baltimore, and director of the Department of Embryology of the Carnegie Institution of Washington, studied structures not simply as morphologic entities but as functioning units. Teacher of teachers, he organized a research institute of embryology. He played a prominent part in the development of many scientific publications. Through the media of these publications valuable information concerning the anatomic nature of cardiac and vascular malformations and a better understanding of the embryologic basis for many of these have been supplied to the profession.

# Persistent Common Atrioventricular Canal

IN THIS heart the atrioventricular canal is undivided and is guarded by a single valve composed of a large anterior cusp, a large posterior cusp and smaller lateral cusps. There is a defect in the lower portion of the atrial septum above the common atrioventricular canal.

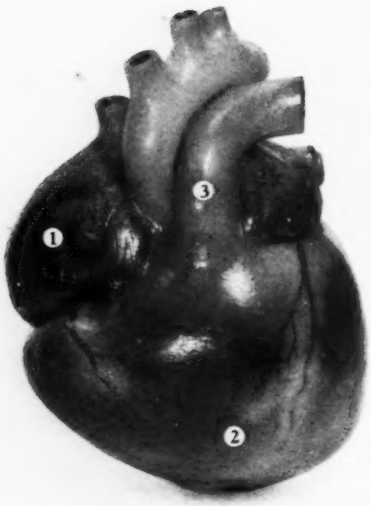



*Fig. 21*—Anterior view (model x1).
(1) Dilated right atrium. (2) Enlarged right ventricle.
(3) Wide pulmonary artery.

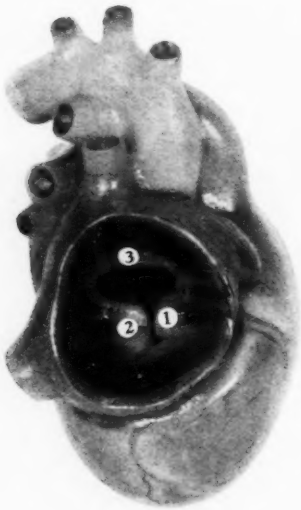



*Fig. 22*—Interior of right atrium viewed from above (model x1).
(1) Anterior cusp of common atrioventricular valve.
(2) Posterior cusp of common atrioventricular valve.
(3) Defect in lower portion of atrial septum.

## History of the Patient

FEMALE, 5 months old. Clinical features of mongolism present. Transient cyanosis at birth. Recurrent cyanosis during feeding and crying. Frequent episodes of "choking." Patient admitted with pneumonia. No murmurs heard. Thoracic roentgenogram showed a large globular heart. Lipoid pneumonia was found at necropsy.

## Principal Clinical Features of this Anomaly

1. Variable degree of cyanosis (the circulatory abnormality often resembles that in atrial septal defect).
2. Usually systolic murmur over midprecordium and apex.
3. Roentgenologic aspects: right and left ventricle equal in size and both enlarged.
4. Electrocardiogram: usually high voltage biphasic QRS complexes in standard and precordial leads.

## Incidence in this Series

Six patients: one stillborn, four patients from 2 to 6 months old and one 36 years old.

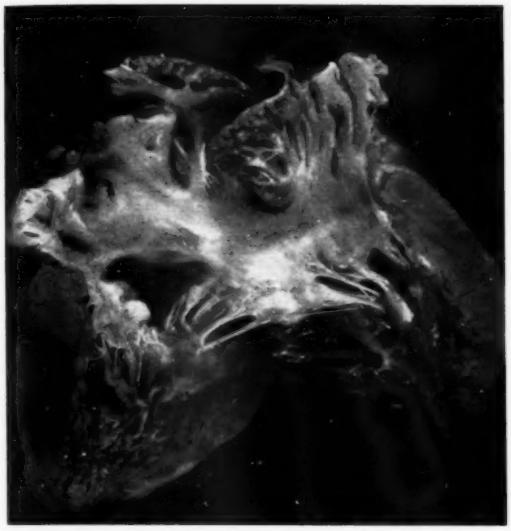


*Fig. 23*—Specimen from which models shown in figures 21 and 22 were prepared. Interior of right atrium and right ventricle.

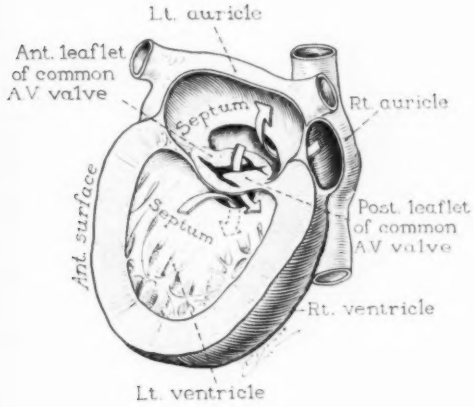



*Fig. 24*—Diagram of intracardiac circulation in persistent common atrioventricular canal.

*Fig. 25*—Thoracic roentgenogram of the patient whose heart is illustrated in figures 21, 22, 23 and 24.

# Atrial Septal Defect

JAMES HOPE

*1801-1841*

That James Hope was the first clinically to diagnose pulmonary stenosis with a venous arterial shunt and to predict the anatomic defects is generally accepted. He closely followed a clinical case, described what he thought would be found post mortem, and was correct (1830). To Julius Friedrich Cohnheim (1839-1884) in 1877 goes the credit for his contribution on paradoxic embolism through a patent foramen ovale.

# Atrial Septal Defect

IN THESE two hearts the anomaly is an atrial septal defect in the form of a patent foramen ovale. As a consequence of the left-to-right shunt, there is enlargement of the right atrium and right ventricle and of the pulmonary artery.

*Fig. 26*—Interior of right atrium viewed from above (model x1).
(1) Margin of large defect in atrial septum.
(2) Dilated right atrium.

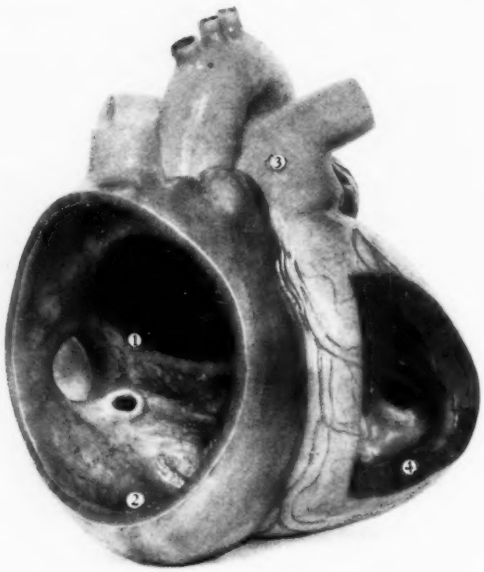



*Fig. 27*—Heart viewed from right (half-size model).
(1) Margin of large defect in atrial septum. (2) Interior of dilated right atrium. (3) Dilated pulmonary artery. (4) Hypertrophied wall of enlarged right ventricle.

## History of these Patients

FEMALE, 5 years old (fig. 26). Periodic cyanosis, beginning at 1 year. Pneumonia at 3 years. No murmurs heard at any time. Intermittent auricular flutter. Patient died with congestive heart failure. Man, 75 years old (fig. 27). Recurring congestive failure for eleven years. Right hemiplegia at 64 years. Loud precordial systolic murmur. Thoracic roentgenogram (fig. 30) shows tremendous enlargement of heart, and electrocardiogram shows right axis deviation. Patient died with congestive heart failure.

## Principal Clinical Features of this Anomaly

1. Characteristically, no cyanosis. 2. Systolic murmur usually present, not diagnostic in type. Accentuated second sound at pulmonary area; occasionally a soft diastolic murmur of pulmonary insufficiency. 3. A major defect may be present for many years without cardiac symptoms. Unexpected sudden death occasionally occurs. 4. Abnormally high oxygen saturation of hemoglobin of blood in right atrium; greatly increased pulmonary blood flow (cardiac catheterization). 5. Roentgenologic aspects: marked enlargement of atria, right ventricle and pulmonary artery. Accentuated hilar pulsations. Occasionally, aneurysmal dilatation of pulmonary artery. 6. Electrocardiogram: right axis deviation. One of the few congenital anomalies in which auricular fibrillation often occurs.

**Incidence in this Series**—Twenty-seven patients (20 adults, of whom 12 were over 50 years old).

*Fig. 28*—Specimen from which the model shown in figure 26 was prepared. Interior of right atrium.

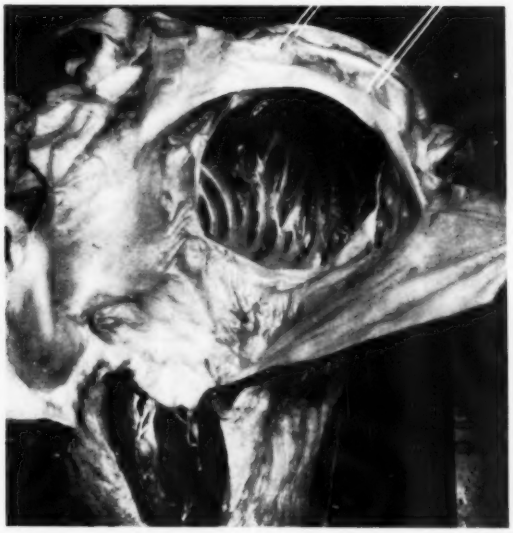


*Fig. 29*—Specimen from which the model shown in figure 27 was prepared. Interior of the left atrium and mitral valve.

*Fig. 30*—Electrocardiogram and thoracic roentgenogram of the patient whose heart is illustrated in figures 27 and 29.

258

# Ventricular Septal Defect

HENRI-LOUIS ROGER

*1809-1891*

Roger demonstrated the presence of a ventricular septal defect, but without stenosis of pulmonary arteries, in a boy who had not been cyanotic during life. Clinical signs in association with an uncomplicated septal defect are so well described that the term "maladie de Roger" came into common usage. He recognized the thrill and described the murmur (bruit de Roger) characteristic of a defect in the ventricular septum.

# Ventricular Septal Defect

TWO TYPES of ventricular septal defects are illustrated by these two hearts. In one the defect is in the muscular portion of the ventricular septum. In the other the defect involves the membranous portion. The latter type is the more common.

*Fig. 31*—Interior of left ventricle (model x1). (1) Margin of defect in muscular portion of ventricular septum. (2) Intact membranous ventricular septum.

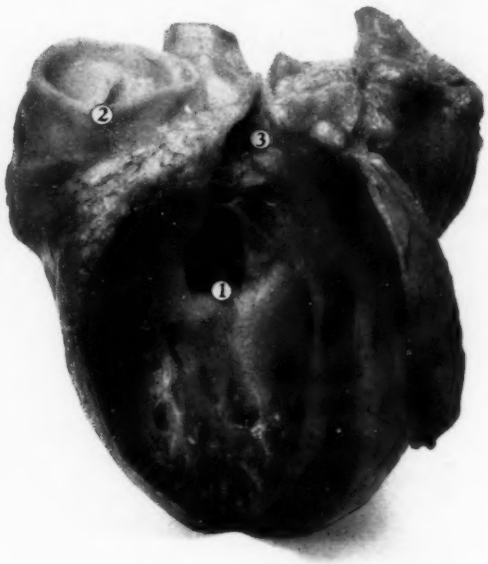



*Fig. 32*—Interior of left ventricle (half-size model). (1) Margin of defect in membranous portion of ventricular septum. (2) Wide pulmonary artery. (3) Aortic orifice.

## History of these Patients

A MALE, 5½ months old (fig. 31), had had feeding difficulty since birth, with poor development. A loud systolic murmur was maximal in third left interspace. Dyspnea present for two months. Roentgenogram (fig. 35) shows moderate enlargement of heart. Progressive failure with terminal cyanosis. A woman 54 years old (fig. 32) at 32 years had had a loud, harsh, systolic murmur over entire precordium, accentuated P-2; mild exertional dyspnea, enlarged heart. She was readmitted at 54 years because of fracture of femur. Slight cyanosis and mild congestive heart failure were found. She died of pulmonary embolism.

## Principal Clinical Features of this Anomaly

1. Loud systolic murmur (Roger murmur) maximal in third left interspace, associated thrill.
2. No cyanosis (interventricular A-V shunt).
3. High oxygen saturation of hemoglobin of blood in right ventricle as compared to that in hemoglobin of blood in right atrium.
4. High incidence of subacute bacterial endocarditis.
5. Roentgenologic aspects: heart is normal in size and contour in most instances.
6. Electrocardiogram: usually normal (congenital heart block, which is rare, usually occurs with this lesion).

**Incidence in this Series**—Sixteen patients (6 were 12 years old or more; three were over 54 years old).

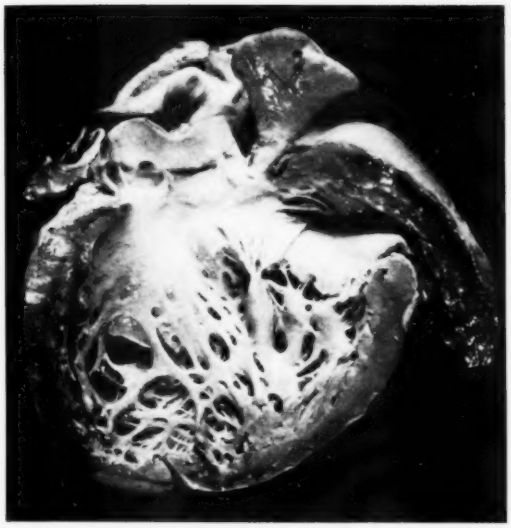


*Fig. 33*—Interior of the left ventricle. Specimen from which the model shown in figure 31 was prepared.

*Fig. 34*—Interior of the left ventricle. Specimen from which the model shown in figure 32 was prepared.

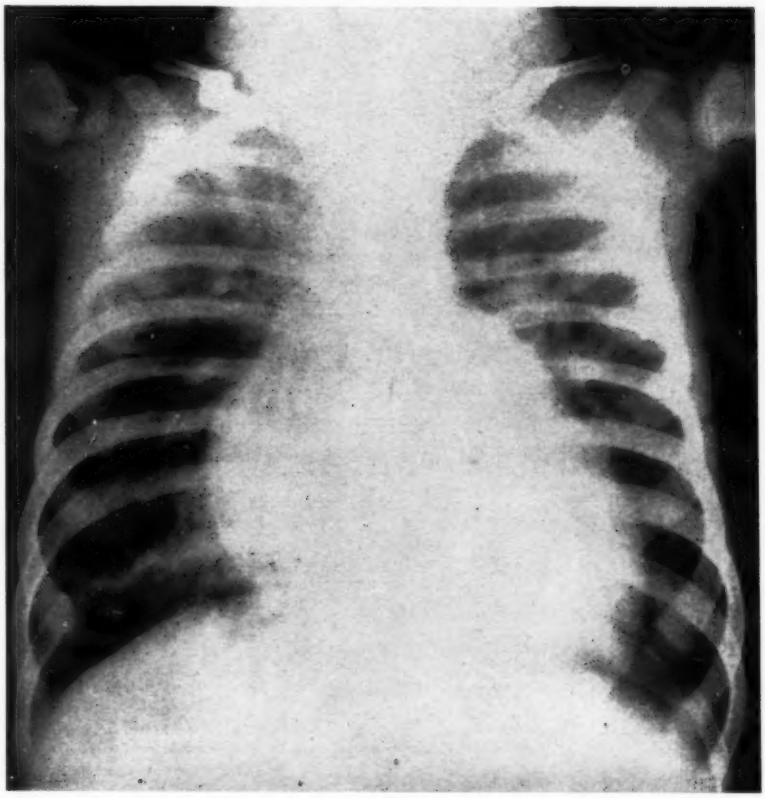


*Fig. 35*—Thoracic roentgenogram of the patient whose heart is illustrated in figures 31 and 33.

262

# Eisenmenger Complex

*(Ventricular Septal Defect with Dextroposition of Aorta)*

VICTOR EISENMENGER

*1864-1932*

Eisenmenger's article appeared in 1897 under the title of "Die angeborenen Defecte der Kammerscheidewand des Herzens." In this article he described a combination of congenital anomalies in which the arrangement is similar to that seen in the tetralogy of Fallot except for the fact that the pulmonary artery, rather than being narrowed, is either normal or dilated.

# Eisenmenger Complex

*(Ventricular Septal Defect with Dextroposition of Aorta)*

IN THIS heart the aorta arises from both ventricles and straddles a defect of the membranous portion of the ventricular septum.

The pulmonary artery, arising from the right ventricle, is dilated and has a normal valve. The right ventricular wall is thick.

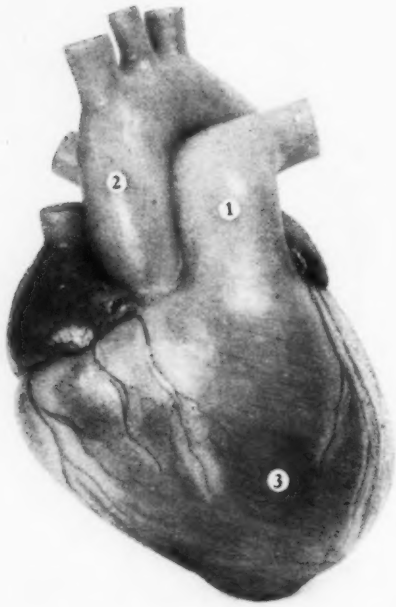



*Fig. 36*—Anterior view (model x1).
(1) Dilated pulmonary artery. (2) Aorta.
(3) Large right ventricle.

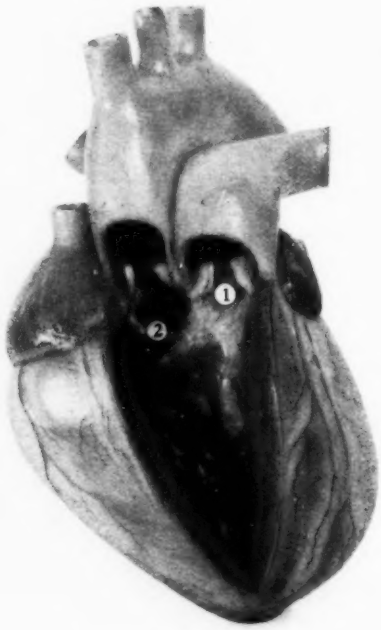



*Fig. 37*—Interior of right ventricle (model x1).
(1) Wide pulmonary orifice. (2) Ventricular septal defect below biventricular origin of aorta.

## History of the Patient

A MALE, 11 months old, with normal development. One week before his admission cough, fever and cyanosis had developed. Heart sounds obscured by wheezes and rales. Hemoglobin 15.6 gm. per 100 cc.; erythrocytes numbered 5,000,000. Thoracic roentgenogram (fig. 40) showed cardiac enlargement and prominent pulmonary conus and hilar markings, consolidation of upper lobe of right lung. Patient died on day of admission, with extensive bronchopneumonia.

## Principal Clinical Features of this Anomaly

1. Cyanosis, often delayed in onset and of increased intensity, with development of polycythemia (oxygen saturation of arterial hemoglobin slightly or moderately decreased).
2. Basal systolic murmur usually present.
3. Pulmonary blood flow not diminished. Pulmonary artery pressure increased (cardiac catheterization).
4. Roentgenologic aspects: right ventricular enlargement and prominent conus shadow.
5. Electrocardiogram: right axis deviation; often large biphasic QRS complexes.

**Incidence in this Series**—Five patients: ages ranged from 2 months to 47 years.

*Fig. 38*—Interior of the left ventricle. Specimen from which the models shown in figures 36 and 37 were prepared.

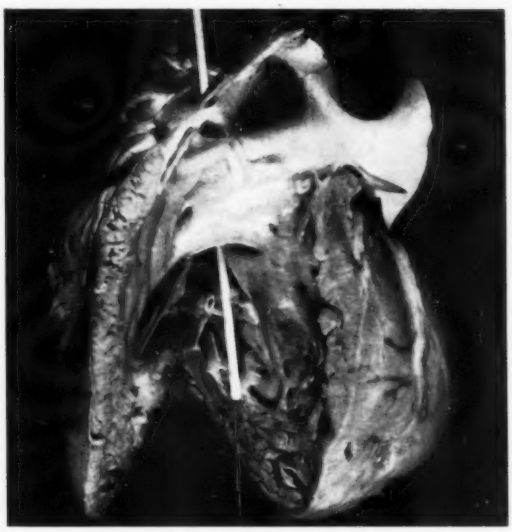


*Fig. 39*—Interior of the right ventricle. Probe in right ventricle and aorta. Specimen shown in figure 38.

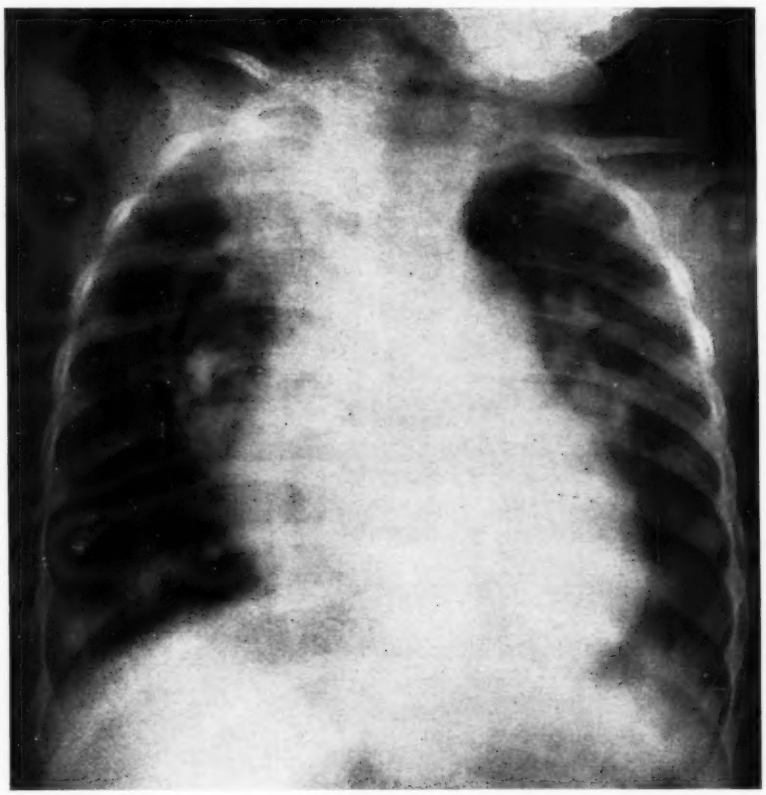


*Fig. 40*—Thoracic roentgenogram of the patient whose heart is illustrated in figures 36, 37, 38 and 39.

# Pioneering in Anesthesiology

RALPH M. WATERS*

MADISON, WISCONSIN

On a cold, windy day in the winter of 1912-13, a medical practitioner in a small city in our Missouri River Valley turned over to me his office, whatever I could retain of his practice, and his bull terrier. He was bound for Vienna, postgraduate study, and, I suspect, specialization in the future. The office was spacious and "well located" over a drug store. The practice which came to me, largely referred by the pharmacists downstairs, most often proved to be drug addicts seeking relief in those days before the Harrison antinarcotic law. The dog, a very unsatisfactory companion for a bachelor, would not eat in the presence of human observers and caused me much inconvenience. I collected $144 in fees the first month without accepting the largest roll of bills I had ever seen up to that time; it was offered by an addict if I would inject a syringeful of cocaine solution into his vein.

One of my duties in conducting the practice was occasionally to administer somnoform (a then popular mixture of ethyl and methyl chloride and ethyl bromide) to the patients of a neighboring dentist. I was permitted to join the informal and unorganized staff of my predecessor's hospital. A surgeon there possessed an apparatus for the administration of nitrous oxide, but no one, except the advertising "painless" dentists, knew how to use this agent. I volunteered, and thus the foundation for my career of specialization was laid.

In general, the line drawn between specialists and general practitioners was at that time neither very straight nor very distinct. For instance, I am sure that 75 per cent of the members of the county medical society attempted, at least occasionally, to perform major surgical operations. I was not without guilt myself in those days. In a then recognized hospital, I once anesthetized a woman while a man removed her uterus without benefit of ligature or suture. Clamps were applied to the vessels *after* the bleeding had become "less active" and the wound was closed about the clamps. Believe it or not, she lived long enough to regain consciousness. In the good old days a suction tip in the anesthetist's hand often supplemented the skill of the surgeon's dissection of numerous pairs of tonsils.

The requirements for specialization in many midwestern hospitals consisted of the possession of sufficient audacity to attempt a procedure and persuasive power adequate to gain the consent of the patient or his family.

With native intelligence and periodic visits to centers of medical learning in this country and abroad, a creditable specialist often eventually resulted. Technics were not so intricate nor was the breadth of knowledge so extensive as at present. Frequently a "half-baked" specialist designated him-

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self as paying "special attention to" this or that. A practitioner especially interested in gynecology for instance, had printed on the door of his office and on his professional cards and stationery, "John Doe, M.D., Special Attention to Diseases of Women." The first formal recognition of limitation in my own practice was upon professional cards carrying the notation "Practice Limited to Obstetrics and Anesthesia." This was solely because I liked to do such work and had no thought of the impossible conflicts in appointment that were bound to occur.

After three years of mixed experience and a month's visit with an eastern anesthetist, my practice in the small midwestern city became "limited to anesthesia." I was a specialist. Many a fellow practitioner in the Mississippi Valley and its tributaries became a specialist in similar fashion in the years before the first World War. To be sure, residencies in some of the specialties were available in hospitals associated with the better medical schools. Occasionally a man studied a specialty for several years in European clinics. On their return these men usually settled in the large centers on the seaboard. Some became specialists by associating themselves with an older preceptor in the specialty. In the main, however, specialists as I saw them in the midwest originated as I have described.

Generally, incomes depended more upon the boldness of the man and his economic acumen than upon his professional proficiency. Then, even more than now, the color of a man's necktie, the length of his waistline, his glibness of tongue, or his cheery manner had much to do with his success. I once had the unpleasant duty of anesthetizing a woman for the removal of her kidney by a "surgeon" who had tied off the ureter at a previous simple hysterectomy. When I returned the patient to her room, the husband detained me for some time with a recitation of the virtues and skill of the operator.

From what I have said, it should be obvious that financial success and even professional recognition in a specialty could be gained without a great outlay of time and study. It was quite another matter regarding one's own self-respect and personal satisfaction. Within a few months of the beginning of my special interest it became evident to me that (1) interest in anesthesia was superficial when it existed at all in this country; (2) opportunities for training were scarce; and (3) such contributions as were being made came largely from those whose primary interest was surgical or that of the laboratory. Real specialists in anesthesia were rare indeed.

In certain centers a very few physicians had interested themselves in the practical and technical aspects of the subject. I found that the source of this interest was Great Britain and that the first scientific specialist in anesthesia (I had almost said the only one) began his practice and his investigations almost with the first public demonstration of surgical anesthesia.

It was on October 16, 1846, that Morton first administered ether at Massachusetts General Hospital in Boston. A month later, John Snow began the study and the administration of ether.[1] Dating from January 28, 1847, he reported that "the ether produced the desired effect in every operation performed in St. George's Hospital." Snow's biographer says, "What had been a mere accidental discovery, I had almost said a lucky adventure, was turned by the touch of the master [Snow] into a veritable science." Although Snow died eleven years later, his influence remained. His scientific study and application explains much of our present knowledge and skill at the end of the first century in the use of anesthesia. The respect in which Snow was held by the profession in Great Britain influenced high-caliber men throughout the British Empire to follow in his footsteps. The few men such as Bennett, Gwathmey, and others who specialized in anesthesia in this country received their inspiration not from New England but from Snow and his followers in Great Britain. To this day, in the British Empire, the administration of anesthetic agents has never been entrusted to those who do not have a medical degree.

I have written elsewhere of the influence of publications and organizations upon the development of this specialty during the present century.[2] Others will record the influence of the recent war. My own effort has been along lines of undergraduate and graduate teaching and investigation; in other words the contribution of the medical school. After ten years of private practice "limited to anesthesia," two things seemed obvious to me. First, improve-

ments in our knowledge of the subject, the whys and hows of both the science and the art, depended upon close cooperation of those who administered drugs in the operating room with those who worked in the laboratories. Only in the medical school can such cooperation be established. Second, so long as the majority of physicians had little or no understanding of the dangers, the importance, and the possible contributions to the welfare of patients which anesthesiology can offer, no improvement or recognition could be expected. Again the medical school was the answer. Only when every medical college is teaching those whom it graduates the real foundations upon which sane administration of narcotic drugs must be based, can we expect the profession to appreciate and demand legitimate service for its patients.

In early days the deplorable belief was common, and still lingers in the minds of some of the profession, that the best in anesthesia lay in the "choice of agent," the selection of a particular drug with some occult fitness for administration in a given case. Little consideration was given to the all-important fact that all known anesthetic drugs and methods of using them often produce dangerous side effects. We were long in recognizing that it is the anticipation and recognition of these undesirable physiologic disturbances accompanying anesthesia and their management and control which constitute wise and safe anesthesia.

In 1927, I was glad to accept a place on the medical faculty at Wisconsin. Objectives of that position from the beginning have been fourfold. In order of their importance they still remain: (1) to provide the best possible service to patients of the institution; (2) to teach what is known of the principles of anesthesiology to all candidates for the medical degree; (3) to help long-term graduate students not only to gain a fundamental knowledge of the subject and to master the art of administration, but also to learn as much as possible of effective methods of teaching; and (4) to accompany these efforts with the encouragement of as much cooperative investigation as is consistent with achieving the first three objectives.

Some of the details of our attempts to carry out these objectives have been published in previous papers.[3, 4, 5, 6] It will be sufficient to say here that we believe our undergraduates have acquired only what is essential by a didactic period once a week during the second half of their third year (junior) and a service of two weeks in the operating room during their senior year. This we feel gives only the minimum of information and experience in anesthesiology necessary for any well-informed physician. If anesthesiology as a specialty is contemplated, a residency of at least three years' duration seems to be advisable. To review our experiences and personal conclusions regarding these residencies at Wisconsin after twenty years may be of interest to others. Some of the conclusions apply to the specialty of anesthesiology only. Others seem to me of general application to graduate instruction in all the specialties.

Possibly by accident, and certainly for selfish reasons at first, resident graduate students in the specialty were chosen who had had some experience in anesthesia as a special interest during a period of general practice. Compared with individuals who come right to specialization from a rotating internship, such residents seemed to have definite advantages. It has been my practice, almost without exception, to urge, if not require, that every applicant for an appointment on our service finish a period of two or three years in general practice before he makes a final decision as to what specialty he desires to enter.

After observing individuals for twenty years, both during their training period and following it, I feel quite sure that an interval in general practice before specialization is highly desirable. I believe that the younger doctor who follows the plan of internship, general practice, final decision as to his specialty, and then a long-term residency will be more successful and more satisfied ten years after graduation than would the same individual if he went into a specialty directly following his internship. This statement, I realize, demands some defense.

From the young man's standpoint it may be argued that a period of general practice before specialization delays the beginning of one's real life work until the individual is too old for real enthusiasm. Economic security may be delayed, and the early establishment of a family and a permanent

home of one's own may be impossible. However, as I look back upon those who have been associated with me in the study of anesthesiology in the long past, these two objections seem to be overbalanced by numerous advantages. At least some of these men who became specialists married, had families, and yet were economically stable and happy.

The hospital staff and management may argue that the resident with previous experience in general practice is intractable, less cooperative, less studious, and more demanding. Some of these objections depend upon the point of view. If, as a primary function, the hospital expects its residents in the specialties to care for its patients, and to do the work of the hospital and the visiting staff, then the younger and less experienced in life they are, the better. For instance, I know of hospitals that have "modernized" their service in my own specialty by replacing former technicians in anesthesia—the so-called "anesthetic nurses" who got a salary of $150 or more a month—with "residents" in anesthesia, young doctors at 25 dollars a month. These "residents" have been allowed to anesthetize patients, private and others, without proper supervision or instruction while the hospital budget is balanced by the fees which it collects for their services.

If, as I believe, residencies or fellowships in the specialties are maintained primarily for the purpose of creating capable specialists who will contribute the maximum in efficient service to the public in the future, it is the responsibility of the hospital to provide time, opportunity, and instructors necessary to prepare them. An immature youngster just finishing his internship may be happy with the opportunity to care for patients independently, to operate upon them, or to anesthetize them, and to permit such experience to be called "training for a specialty." The man with experience in general practice does not accept such conditions as "graduate training for a specialty." We, as staff members and hospital administrators, must guard against having opinions or supporting practices which contribute to the convenience of the visiting staff and the economic security of the hospital at the expense of the quality of special training offered. I am suggesting that the maturity of the man who begins to specialize after a brief experience in general practice will prevent us—teachers, visiting staff, and hospital administrators—from exploiting, however unconsciously, the graduate student.

But, you say, common honesty and understanding on our part will prevent exploitation of the graduate student. Agreed. What then are the real advantages of the plan I am proposing? They extend in two directions—to the community and to the young doctor. One of our unsolved problems in recent years has been the deficiency of available family practitioners to serve our smaller communities. If every medical graduate, on finishing his internship, were to undertake a short period of general practice, this shortage would not exist. A few months or years of such experience gives the young doctor an opportunity to learn how to collect and spend money, how to conduct himself in his relations with the community in which he lives, with patients and their families, and with other physicians. It is so easy to acquire a critical and unsympathetic attitude in a specialty. It is less easy when one has lived "on the other side of the fence." But more especially the young doctor during general experience will see all sides of the practice of medicine; he will refer cases to specialists; he will learn that no patient is the problem of a single specialty. While making these observations, he will be in a position to decide just what specialty he will really enjoy and where his inclinations and skills will fit.

What about the community when he leaves to begin his special residency or his fellowship? Once the custom becomes established, will not a heritance develop much as it operates now regarding internships? Certain schools establish the custom of sending a man to this hospital, another to that, each year. As long as the hospital is satisfied, the habit continues. Sometimes it is a fraternity or some other small group which determines what hospital a particular senior will choose for his internship. Would not the same habit develop in determining where he would enter general practice the next year? The office, equipment, even the motor car and living quarters, might be handed down in a similar manner. If, as I am sure would happen, an occasional young doctor decided that he likes general practice and did not return for training in a specialty, I believe both the community and the pro-

fession would benefit by the doctor's decision.

To implement such a plan as I am advocating, a slight change is necessary in customs among administrators. Interns have said to me, "I like the idea of having experience in general practice before I decide what specialty I shall enter. But I get the impression that it will be next to impossible for me to secure a desirable appointment in a first-class department unless I arrange for it while I am an intern." Obviously, if the intern waits to avail himself of experience and maturity before choosing his life work, he must not be penalized for it. If more mature individuals are appointed, it is my firm conviction that the hospital superintendent and the director of training in any specialty will observe benefit not only to the graduate student but also to the service.

Even when a person has the advantage of a period of general practice during which he decides upon a specialty, he may be mistaken regarding his preference. Actual experience may prove that his aptitudes lie elsewhere. Both the candidate and our department always look upon the first six months of a resident's service as a trial period. If either side decides that a mistake has been made, we try to rectify it as soon as possible. Although these methods of deliberation in planning one's future may seem like waste of time, they make for satisfaction and success in later life. Everyone is not intrinsically equipped to be a surgeon, an obstetrician, an internist, or an anesthetist. May it not be advantageous to spend a reasonable time in deliberation and experimentation? Certainly there should be no disgrace attached to changing one's mind about the choice of his future life work. If the choice has been right, life is a joy forever after. Uncongenial work is drudgery.

What does the evidence show in the later experience of our own men who have gone out as specialists in anesthesiology? I am quite willing to admit that the number has been altogether too small to have the slightest statistical significance. We have had with us residents of three categories: (1) those who came to the specialty from their internships; (2) those who have had an interval of two or three years in general practice; and (3) a few who have come to us late in life, sometimes after part-time specialization for some years. What can we say of their comparative accomplishments?

Those in the first group acquire knowledge and technical facility as readily as the others. On the other hand, as a group while in residency they show less good judgment, less independence of thought, and less self-reliance. They are more, rather than less, likely to give evidence of brashness or foolhardy conduct. After leaving us, when "out on their own," the first group have had more difficulty in building a place for themselves in the world. Their relations with hospital staff or medical school faculty, with hospital administrators, and with the community at large, have been more difficult at first and satisfactory adjustments have been made much more slowly.

The second group, who have returned after an experience of two or three years in general practice, have, in our experience, shown little or no tendency to resist the necessary routine of a department, record-keeping, cooperation, and the like. They have adjusted to institutional life without difficulty. As a group, they offer more original ideas, good and bad, which not only prove a healthy stimulus to discussion in the department and to investigative effort, but also at times result in change of conviction in the department. The advantage to us and to our institution deriving from this second group over the first, though noticeable, may not have been great. The advantages to the resident himself, however, both during his training and in later life, seem to us considerable. He comes to us after a mature choice of what he wants to do. He works harder and grasps his opportunities with more vigor. Possibly the fact that he is older and more mature when he begins to practice "on his own" explains some of his advantage. However, I do not believe that age and maturity are the only factors. The broad viewpoint acquired as a general practitioner remains with him as a specialist. Experience in economic and social relations does not have to be acquired at a time when he is trying to establish himself as a specialist.

Finally, what of those in the third category who have been out in the world for a good many years either as part-time specialists or as general practitioners? Some of these are merely men who,

through failing health, deficient professional background, or desire for change, wish to specialize. These must be discouraged at once. An old dog doesn't learn new tricks very easily. As a rule, those in the third class do not fit into a residency program nor do they benefit themselves thereby. We have met a few exceptions to the rule, but these are rare indeed.

Personal acquaintance with candidates through long correspondence and at least one protracted personal interview is necessary if the director of a training program is to fulfill all his obligations. These extend not only to the applicant but to the applicant's prospective fellow students, to the specialty and last, but most important of all, to the medical profession as a whole and the service it will render to the public. If we cannot help young physicians to become specialists who will be a credit to our profession, if we do not put them in a position to perform a useful service in years to come, our efforts had better not be devoted to the "training of specialists."

## SUMMARY

Specialization in medical practice has developed as knowledge and skills have extended with the years. Methods of preparation of specialists have varied widely. I have recited some personal experiences and observations both as student and as teacher. The very informal customs I have described as being characteristic of some parts of our midwest at the time I began practice in 1913 had certain advantages. Independence, self-reliance, and originality were developed; or at least these qualities, when naturally present, were not diminished. Sometimes, however, the freedom allowed led to boldness, rashness, and foolhardy practice, resulting, in certain cases, in disaster and death, if not murder. Certainly it was not the ideal manner of preparation. We have speculated as to how the advantages of the informal, individualistic method of learning to be a specialist can be combined with the advantages of the formal training that is customary at the present time.

I think we may conclude that familiarity with physiologic functions and the manner in which these are affected by therapeutic procedure is the essential background of specialization. Added to such familiarity, technical skills in diagnosis and treatment are not enough to produce a real specialist. He must also have a rational, well-rounded attitude toward the general problems involved in the practice of medicine and the care of the sick. If our training of specialists sacrifices one of these three factors, either scientific background, special skills, or a rational, well-rounded attitude, it is not very successful.

Having tried to select those candidates for special training in anesthesiology who have conducted a general practice after internship and having watched a fairly large number of these later as specialists, in comparison with others who began to specialize directly after internship, I cannot avoid certain definite impressions.

1. The former general practitioners are happier and are better satisfied with their specialty.

2. They are more successful and more convincing professionally as specialists.

3. They more easily and completely command the respect and the economic recognition of fellow physicians, hospital administrators, and the public.

It is my belief that a young person will act for his own and the communities' best interest if he delays decision as to specialization and his choice of a specialty until he has passed through at least a short period in the general practice of medicine or its equivalent.

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# The Medical Bookman

THE DIGESTIVE TRACT IN ROENTGENOLOGY, by Jacob Buckstein, M.D., Assistant Professor of Clinical Medicine, Cornell University Medical College; Visiting Roentgenologist (Alimentary Tract Division) Bellevue Hospital, New York City; Attending Gastroenterologist, Beth David Hospital, New York City; Consultant in Gastro-Enterology, Central Islip State Hospital, New York. 889 pages with 1030 illustrations, including 659 figures. Philadelphia, J. B. Lippincott Company, 1948. Price $16.00.

For more than twenty-five years, Jacob Buckstein has made roentgenologic examinations of the digestive system in Bellevue and other New York hospitals. He has assiduously correlated his observations and opinions with clinical, operative and postmortem data. From this extensive and comprehensive experience, augmented by that of a large private practice, he has described and explained normal and abnormal conditions of the alimentary tract and ancillary organs. The expository text is supplemented by abundant and pertinent case records.

The sections on the small intestine contain important material, and the plates of ascariasis and hookworm are unusual. Roentgenologic consideration of the appendix is also uncommon, but sensible and satisfactory.

The numerous illustrations aptly identify the material discussed, but many of the reproductions are slightly dim and blurred, probably because of having been used in the author's other publications.

In general the references are not up to date, but do list original articles of historical interest. The chapter on gastritis in particular is incomplete, and does not include recent data.

The opinion of the value of properly interpreted observations of the progress meal for study of colon function is conservative, and justly assigns significance to this procedure. Several usually neglected subjects such as valvulus of the sigmoid and eventration of the diaphragm are adequately mentioned.

The emphasis given normal appearance and insignificant abnormalities of the alimentary tract and accessory organs is gratifying and should instruct inexperienced radiologists.

The historical backgrounds introductory to the major subjects are interesting.

J. B. C.

TREATMENT OF HEART DISEASE. By William A. Brams, M.S., M.D., Ph.D., Associate Professor of Medicine, Northwestern University Medical School, and Attending Physician, Michael Reese Hospital, Chicago. 195 pages, with 11 figures. New, 1st Edition. 1948, W. B. Saunders Company, Philadelphia & London. Price $3.50.

This book comprises a systematic and practical guide in the treatment of heart disease, based on the author's own experience in private and hospital practice. Dr. Brams has devoted space to discussion of such important coexisting conditions, as diabetes, thyrotoxicosis, pregnancy, etc., as they relate to the treatment of heart disease. He also stresses the treatment of congestive heart failure, as he believes that ability to treat congestive heart failure is an essential prerequisite for successful treatment of heart disease.

MODERN CLINICAL PSYCHIATRY. By Arthur P. Noyes, M.D., Superintendent, Norristown State Hospital, Norristown, Pa. 525 pages. 3rd Edition. 1948, W. B. Saunders Company, Philadelphia & London. Price $6.00.

This book has been re-written to state more fully and clearly the genesis, dynamics, and manifestations of personality functioning incident to dealing with the anxieties and frustrations attendant to the task of living. The author believes that any concept which deals with personality functions must take into consideration the integrated facts of biology—anatomic, physiologic, chemical, and psychologic. He has attempted, therefore, to construct these concepts of personality functioning in psychobiologic terms, that is, in terms of total integration of the organism.

A HISTORY OF THE HEART AND THE CIRCULATION. By Frederick A. Willius, M.D., M.S. in Med., Senior Consultant in Cardiology, Mayo Clinic; Professor of Medicine, Mayo Foundation for Medical Education and Research, Graduate School, University of Minnesota; and Thomas J. Dry, M.A., M.B., Ch.B., M.S. in Med., Consultant, Section on Cardiology, Mayo Clinic; Associate Professor of Medicine, Mayo Foundation for Medical Education and Research, Graduate School, University of Minnesota. 456 pages, illustrated. 1948, W. B. Saunders Company, Philadelphia & London. Price $8.00.

Dr. Donald C. Balfour, who recently retired from his position as Director of the Mayo Foundation for Medical Education and Research, says in the preface to this book: "In a systematic approach toward any project to advance knowledge in a field it is axiomatic that intimate knowledge and understanding of the historical data pertaining to the field are essential. . . . This is particularly true in the field of cardiology, for of all the diseases which afflict mankind, heart disease occupies a place of ever-increasing importance among the medical specialties."

HANDBOOK OF TREATMENT and Medical Formulary. By Charles M. Gruber, Ph.D., M.D., Professor of Pharmacology, Jefferson Medical College, Philadelphia. 585 pages. 1948, F. A. Davis Company, Philadelphia. Price $7.00.

This book has been designed to present in condensed form the essentials of modern treatment for practically every disease the clinician may be called upon to handle. Under each alphabetically listed disease are explicit directions on care and management, selected prescriptions, and differential diagnosis where helpful. The nearly 1,500 selected prescriptions include the most recent information on the use of therapeutic agents and procedures, as well as the older remedies that have been proved efficacious and rational.

PERIPHERAL VASCULAR DISEASES, Diagnosis and Treatment. By David W. Kramer, M.D., F.A.C.P., Associate Professor of Medicine, Jefferson Medical College. Foreword by Edward L. Bortz, M.D. 620 pages, 157 illustrations with 25 in color. 1948, F. A. Davis Company, Philadelphia. Price $8.00.

As Dr. Edward L. Bortz says in the foreword of Dr. Kramer's book, "Disturbances of the peripheral vascular system represent a large group of important problems and. . . . Here is a volume that squarely meets the needs of the modern practitioner. One finds here a clear description of the important diseases which is of value in appraising the efficiency of the peripheral circulation. Points of differential diagnosis have been accentuated. Significance of newer therapeutic procedures and agents has been stressed, and detailed instructions for their use are given."

PRACTICAL BACTERIOLOGY, HEMATOLOGY AND PARASITOLOGY, by E. R. Stitt, M.D., Ph.M., Sc.D., LL.D., Rear Admiral, Medical Corps, Surgeon, U.S. Navy, Rtd.; Paul W. Clough, M.D., Physician-in-Charge of Diagnostic Clinic, Johns Hopkins Hospital; and Sara E. Branham, M.D., Ph.D., Sc.D., Senior Bacteriologist, National Institute of Health. 10th Edition, 991 pages, 765 illustrations. Philadelphia: The Blakiston Company, 1948. Price $10.00.

This edition, prepared with the collaboration of specialists in the various fields, presents all types of laboratory procedures, including clinical chemistry. Emphasis has been placed on the practical details of technic, guidance in the selection of approved methods, and interpretation of findings. The book is divided into four main sections under the headings of: (1) Bacteriology, (2) Hematology, (3) Parasitology, and (4) Clinical and Pathologic Examinations of Body Fluids and Organs.

HEMOSTATIC AGENTS. By Walter H. Seegers, M.S., Ph.D., Professor of Physiology, Wayne University College of Medicine, Detroit; and Elwood A. Sharp, M.D., Sc.D , Director, Department of Clinical Investigation, Parke, Davis and Company; Lecturer, Department of Medicine, Wayne University College of Medicine, Detroit. 131 pages, with 27 illustrations, some in color. 1948, Charles C Thomas, Springfield, Ill. Price $4.75.

Based on developments during the past few years, this monograph is intended to cover the subject of coagulants and their clinical utility. A summary of blood coagulation mechanisms has been included by the authors to consolidate scattered information and as orientation for the successful use of modern hemostatic agents in surgical practice.

CONTROL OF PAIN WITH SADDLE BLOCK AND HIGHER SPINAL ANESTHESIA. Edited by J. H. Walton, M.D., with illustrations by Frank H. Netter, M.D. 52 pages, including 12 color plates. Summit, New Jersey: Ciba Pharmaceutical Products, Inc., 1948.

CORONARY HEART DISEASE. By A. Carlton Ernstene, M.D., Chief of the Section on Cardiovascular Disease, Cleveland Clinic, Cleveland, Ohio. 102 pages. 1948, Charles C Thomas, Springfield, Ill. Price $2.50.

This monograph is an excellent summary of the subject of coronary heart disease. The author describes the principal clinical manifestations of the disease such as angina pectoris, acute myocardial infarction, acute coronary failure, paroxysmal dyspnea, auriculoventricular and intraventricular block, other disturbances of cardiac rhythm, and congestive heart failure.

Recent advances in methods of diagnosis and treatment are discussed and the subject is brought up to date in all ways.

The book is written in a clear and concise style and should prove a valuable addition to the library of everyone interested in the subject of coronary heart disease.

T. Z.

# EDITORIALS

## GASTRIC CANCER

Fifty years ago, only one gastric cancer in every 100 was resectable. Today, of those patients treated in medical centers, one in every 3 or 4 is reported as resectable. But this fact, however suggestive of surgical progress, has only academic interest, for it reveals but a small segment of the truth. A recent survey of deaths from "cancer of the stomach" in a representative metropolitan area demonstrated that two-thirds of the victims never entered a hospital. Less than 6 per cent were given the benefit of gastric resection. Obviously, therefore, if this survey reflects the true community picture, operative mortality could be reduced to zero, and still 94 per cent of all gastric cancer patients would die of the disease.

Real improvement in the cure-rate, therefore, depends upon those persons who first see the patient, and whose responsibility it is to make the diagnosis and get the patient to surgery. These men include the family doctor, the diagnostician, and the roentgenologist. If these physicians fail in their diagnosis, or if they delay in getting the patient to surgery, no amount of surgical skill will save him. But if they render an accurate diagnosis, and provide surgical treatment prior to lymph node involvement, then the patient has at least a 50-50 chance to live five years.

The medical treatment of gastric carcinoma leads only to death. Consequently, all gastric ulcers should be regarded as malignant until they are proved otherwise. One investigator has graded stomach ulcers in terms of coins. Those ulcers larger than a silver dollar he regards as almost certainly malignant. Of all lesions between the size of a quarter and that of a dollar, one half are carcinoma. Since this crude diagnostic formula is just about as accurate as anything else short of surgery, the physician might do well to manage a small gastric ulcer of doubtful malignancy as follows: a careful, accurate and aggressive medical trial may be allowed for a period not to exceed two or three weeks. If the ulcer does not heal within that time, the final test should be made to determine its true nature. This requires a surgical exploration; the ulcer should be biopsied, and its nature determined while the abdomen is still open. The mortality rate from this operation should be less than one per cent. Continued medical management of a malignant ulcer yields a 100 per cent mortality rate.

Improvement in survival rates from gastric cancer depends almost entirely upon earlier diagnosis of gastric lesions. Several new technics are now being studied, which undoubtedly will lead to more accurate diagnoses. At the present time, however, relatively few diagnosticians are competent in the use of these technics. As time goes on, this condition should improve. Biopsy with the aid of the gastroscope is still being experimented with; it is a promising technic. Skillfully employed, the fluoroscope yields diagnoses of gastric lesions which are accurate in about 95 per cent of cases. Perhaps the most interesting diagnostic development is the use of the Papanicolaou technic in detecting exfoliated malignant epithelial cells in the gastric contents. This may prove to be the "screening test" that so many have been hopeful of developing. Fluoroscopic examination of large unselected groups of people offers little encouragement, but such an exam-

ination of those brought into focus by gastric analysis and Papanicolaou test smears would be quite feasible. There can be little doubt that as these improved technics of diagnosis become more widely used, gastric cancer will become a less fatal disease.

Today, operations are being successfully performed which, prior to the development of anesthesiology and chemotherapeutics, would have been impossible. Total gastric resection is now being performed with fairly acceptable mortality figures while only ten years ago few series claimed less than 50 per cent. More frequent removal of the total stomach is being recommended for smaller lesions. It is possible that the principles stated by Halstead for radical removal of cancer of the breast may well be adopted for cancer of the stomach. Gastric resection, however, must not be considered a casual operation; nor should it be performed by a casual surgeon.

From 40,000 to 50,000 gastric carcinomas appear annually in the United States. From the best criteria available for comparison only 10,000 of these are to be considered resectable when first seen. Further, it is estimated that at least 10,000 persons die every year from gastric cancers that are still in resectable stages. These large numbers illustrate what an enormous gap exists between our present, available knowledge and our functional use of it in this disease. Small percentage gains in cure of cancer of the stomach have just as great practical significance as a far greater percentage gain from the cure of malignancies in other organs where the occurrence is of lower incidence in the population. A 2 to 5 per cent increase in the cures of cancer of the stomach means a salvage of more lives than from the 100 per cent cure of all cancers of the lip that occur in one year.

R. L. C.

## DOCTORS OF HAPPINESS AND HEALTH

AMERICANS are traditionally jealous of their rights to life, liberty, and the pursuit of happiness. To these, some would also add the right to health, to be guaranteed by law. Whether or not the government ever could guarantee health, depends, of course, upon whether one concedes that it is possible to legislate people into being healthy. Past experience of other countries who have tried this venture seems to prove conclusively that it cannot be done. Perhaps more could be accomplished if the people and their physicians concentrated more on the third of the freedom triad, the pursuit of happiness. For therein, it seems apparent, lies an important key to health. Traditionally, people strive to be healthy in order to be happy. Isn't it even more important to strive for happiness, in order to obtain health?

The recent progress in psychosomatic medicine has shown that emotional calmness, an indispensable prerequisite to happiness, is also necessary for physical health. Every doctor has patients who manage to be quite happy, although very unhealthy, sometimes being hopeless invalids. But who can remember many who were chronically unhappy over a very long period of time without being ill, often physically as well as mentally? Recognition of the emotional tension of unhappiness is not too difficult, once the search is begun. And the search does yield dividends, once the physician seeking a diagnosis takes the trouble to make it. Dr. Walter Alvarez sums this up in a foreword to *Brief Psychotherapy* by Bertrand F. Frohman, M.D. (Lea & Febiger):

"Actually, because of the way he is trained at college, if an able young assistant were to see his chief diagnose a neurosis at a glance or after a few searching questions, and then see him start treatment without going on to take all the patient's spare cash for a complete overhauling, I think he, the assistant, would be upset; he would feel that his chief was too old-fashioned and unscientific to be trustworthy."

Doctors need no longer be ashamed of this type of acumen, which, unfortunately, few possess. The old family doctor often had it, but on the other hand he often used vague generalities to cover an appalling ignorance of the rapid strides that scientific medicine was mak-

ing. Were he practicing today, he would be equally far behind in the field of psychosomatic medicine, for it, too, has become a science. The old family practitioner was close enough to his patients to recognize their unhappiness and when subsequently it resulted in poor health, he was in the way of expecting it. The doctor of today is rarely on such intimate terms with his patients, so we need very badly to learn ways of discovering unhappiness in our patients, scientific ways, if we must have science, willy-nilly. Actually, there are such scientific ways which can easily be learned by every doctor and should be ingrained into the young physician while he is learning his trade. Medical science can relieve the pain of an ulcer through diet, medication, or even cutting the vagus nerve, but who takes the trouble to see that the chronic unhappiness that largely caused the ulcer in the first place has been cured? There lies *real* preventive medicine.

If, as physicians, we are custodians of the health of those we serve, then we are equally the custodians of their happiness, and it behooves us to inquire into ways of uncovering emotional discontent and relieving it. Only then will we be practicing the real idealistic medicine to which we are dedicated, and perhaps earn the accolade given to Luke, "The Beloved Physician."

F. G. S.

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# New Drugs and Instruments

Information published in this department has been supplied by the manufacturers of the products described.

## VI-LITRON WITH FOLIC ACID

PURPOSE: Prevention and treatment of many forms of anemia.

COMPOSITION: Each VI-LITRON capsule contains:

| | |
|---|---|
| Liver concentrate* | 218 gm. |
| Ferrous sulphate | 3 gr. |
| Ascorbic acid (C) | 20 mg. |
| Folic acid | 2 mg. |
| Thiamine ($B_1$) | 2 mg. |
| Riboflavin ($B_2$) | 2 mg. |
| Niacinamide | 10 mg. |
| d-calcium pantothenate | 1 mg. |

*Anti-secondary anemia fraction derived from 12 gm. of liver.

DOSAGE AND ADMINISTRATION: 3 to 6 capsules daily or as needed.

HOW SUPPLIED: VI-LITRON with FOLIC ACID: in packages of 48, 96, 200, and 600 capsules.

PRODUCER: U.S. Vitamin Corporation, New York, N.Y.

## ENTEROGASTRONE HYDROCHLORIDE

PURPOSE: Symptomatic relief of peptic ulcers.

COMPOSITION: A sterile, lyophilized extract of the upper portion of the small intestine of hogs, containing principles that inhibit gastric secretion and protect gastric and duodenal mucosa from ulceration.

INDICATIONS FOR USE: For providing relief of symptoms of peptic ulcers usually within a few days, and healing within two to five months after initiation of treatment.

DOSAGE AND ADMINISTRATION: Daily dose is 200 mg. dissolved in 4 to 5 cc. of sterile water, given intramuscularly only. Injections are made daily except Sunday for a period of one year.

CAUTIONS: Intradermal sensitivity tests should be made prior to use, particularly in patients with history of allergy.

HOW SUPPLIED: Package containing 200 mg. enterogastrone hydrochloride in a 10 cc. vial, and one 5 cc. ampule sterile water.

PRODUCER: The Upjohn Company, Kalamazoo 99, Mich.

## PENICILLIN *DULCET* TABLETS

PURPOSE: They are designed especially for children.

DESCRIPTION: They are like candies in appearance, taste, and odor, yet are accurately standardized medication. Each white, cinnamon-flavored, buffered tablet provides 50,000 units of crystalline penicillin G sodium.

INDICATIONS FOR USE: The same as those for other oral penicillin preparations.

ADMINISTRATION AND DOSAGE: The same as for other oral penicillin preparations.

HOW SUPPLIED: Penicillin *Dulcet* Tablets (Buffered), 50,000 units, are supplied in bottles of 12.

PRODUCER: Abbott Laboratories, North Chicago, Ill.

## DAZOR SUN-HEAT LAMP FIXTURE

DESCRIPTION: The Dazor Sun-Heat Lamp Fixture is of the pedestal-type having a circular cast iron base. Above the base is an upright bearing the switch box and the pivot for the floating arm bracket. The reflector housing at the far end of the outer arm contains a plastic heat-resistant handle for positioning. The fixture is especially useful in connection with RS sun bulbs drawing 275 watts on 110 to 125 volts alternating current and R-40 heat bulbs drawing 250 watts on 110 to 125 volts alternating or direct current. The diameter of the base is about 30 cm. (12 inches), and the whole weighs 11.3 kg. (24⅞ pounds); the shipping weight is 17 kg. (37½ pounds).

PRODUCER: Dazor Manufacturing Corp., St. Louis, Mo.

## VIDEROL

PURPOSE: For treatment of arthritis and associated fibrositis.

COMPOSITION: Each capsule contains:

| | |
|---|---|
| Vitamin D (as viosterol) | 50,000 units |
| Mixed Tocopherols | 50 mg. |
| Desicol (whole bile) (2½ gr.) | 150 mg. |

INDICATIONS FOR USE: Chronic arthritis and conditions associated with primary fibrositis.

DOSAGE AND ADMINISTRATION: Best results are obtained when Capsules Viderol are administered in maximum tolerated doses. For the average patient the following dosage schedule will usually be satisfactory: initially, 1 capsule three times daily for three days, then increased every third day by 1 capsule until 6 capsules are taken daily. This dosage should be continued until improvement is obtained and then gradually reduced. Since effective doses vary for each individual, it is important that the patient be kept under close observation and dosage adjusted according to response. If toxic manifestations such as nausea, vomiting, frequency of urination, or nocturia are encountered at any dosage level, Viderol therapy should be discontinued for one week, then resumed and increased gradually until a maximum of 6 capsules are being administered daily. If toxic manifestations recur, high vitamin D therapy should be discontinued.

HOW SUPPLIED: Bottles of 100 and 500 capsules.

PRODUCER: Parke, Davis & Company, Detroit 32, Mich.

## BIOGELS

PURPOSE: Multivitamin capsules for diet supplementation.

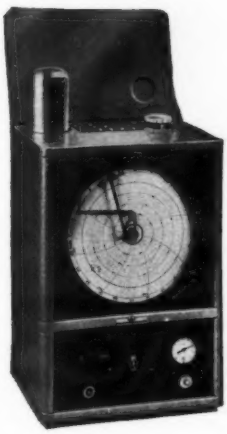
COMPOSITION:

| | In each Biogels capsule | Minimum adult daily requirement |
|---|---|---|
| Vitamin A | 5,000 USP units | 4,000 USP units |
| Vitamin D | 500 USP units | 400 USP units |
| Vitamin $B_1$ (thiamin hydrochloride) | 3.0 mg. | 1.0 mg. |
| Vitamin $B_2$ (G) (riboflavin) | 3.0 mg. | 2.0 mg. |
| Vitamin C (ascorbic acid) | 100.0 mg. | 30.0 mg. |
| Nicotinamide | 50.0 mg. | Not established; 12 to 23 mg. recommended by National Research Council |
| Calcium pantothenate | 5.0 mg. | Not established |
| Vitamin $B_6$ (pyridoxine) | .05 mg. | Not established |
| Vitamin E (mixed tocopherols) | 5.0 mg. | Not established |

DOSAGE: One Biogels capsule supplies more than the minimum daily requirements of vitamins A, $B_1$, $B_2$, C, and D for prophylactic purposes, with a generous margin of safety.

HOW SUPPLIED: Bottles of 100 soft gelatin capsules, specially designed to facilitate swallowing.

PRODUCER: Bristol Laboratories, Inc., Syracuse, N.Y.



## KIDDE UTERO-TUBAL INSUFFLATOR

The Kidde Tubal Insufflator offers the gynecologist a safe, simple means of carbon dioxide gas tubal insufflation. A weighted piston called the Gasometer has been injected in the carbon dioxide line between the high pressure source and the outlet to the patient so that there is no possibility of introducing a pressure surge into the patient because of the unfailing gravity control. The Kidde unit is not dependent upon the function or nonfunction of valves. It is supplied with either the direct recording Kymograph or Mercurial Manometer pressure recorder.

At a slight additional cost, the Kidde Opaque Oil attachment which holds the opaque medium delivers this medium to the patient under the automatic and positive pressure control of the gasometer in the Kidde Tubal Insufflator.

PRODUCER: Kidde Manufacturing Co., Inc., Bloomfield, N.J.

## ACNOMEL

PURPOSE: For effective acne therapy.

COMPOSITION: Resorcinol, 2 per cent; sulfur, 8 per cent; in a stable, grease-free, pleasantly scented, flesh-tinted vehicle.

DESCRIPTION: Acnomel is entirely free from wax, oil, or other greasy substance, is a cosmetically superior treatment for acne and rosacea.

INDICATIONS FOR USE: Acne vulgaris and acne rosacea.

CAUTIONS: Should not be applied to diffuse, acutely inflamed areas. Use with care near the eyes. In blonde and dry-skinned persons, the erythema and scaling which are normal and expected results of the application of Acnomel may become too marked. If this occurs, its use should be discontinued until inflammation has subsided, and, thereafter, should be applied at longer intervals.

HOW SUPPLIED: In 1½ ounce tubes, specially lined to preserve the quality, since Acnomel is designed to dry quickly when applied.

PRODUCER: Smith, Kline & French Laboratories, Philadelphia 5, Pa.

# *Leaves from a Doctor's Diary*

By Maurice Chideckel

*August 1* . . . Spoke colleague Burt: "The human animal, not unlike all living matter, is subject to unpredictable changes which we scientists call mutation."

The fibroma of bachelor maiden Elizabeth, for example. That fibroma. It constitutes a poignant record of a unique experience, both intellectual and emotional. The virgin sat and listened to specialist Eddinton as he learnedly delivered for her his dissertation on uterine tumors, of the malignant that break down their barriers and of the benign; of the submucous, the interstitial, and the peritoneal. Her tumor is what "we gynecologists" call encapsulated "and I shall shell it out of its bed like that." He snapped his fingers as an illustration of his skill.

But the female wizard took sick and Elizabeth would have no one else. Hence she waited. But the tumor would not stay put. One dark night the maiden felt pain and as it grew in intensity I was summoned. What a strange apparition of a neoplasm, for I could hear a heart beating into it. Pain and more pain, a burst of fluid and out came the tumor shrieking and kicking. Bewilderment, shock and doubt as a little girl of seven pounds was placed alongside of her. "How did that thing ever get into me?" she asked and shrugged her shoulders. No, no. The audacity of my inquiries. No man ever dared any familiarity with her. "Take that creature away," she commanded.

Before dawn that fine baby was in the house of a childless, cultured couple. That was one year ago today. The mother instinct must have awakened of a sudden in the virgin mother. She was leaving town and she wants that baby "you found in my bed." But that good couple have long ago left for California where they now reside. "Have another baby," I advised her. "How?" she thundered. "Use the same method you employed in the first one," I heartily recommended. Her lips quivered. "So you still believe that I indulged in—." As she took a pitcher from the table to transmit it to my head I thought best to retire.

*And there is Solomon Wise who is not wise at all, for he is rocking a baby and thinks he is rocking his own. When told that she was pregnant three months, Margaret married Wise the same day. She suddenly became so lonely for him, and she loved him so. Of course it was a premature baby. The fact that it weighed eight and a half pounds is beside the point. And Sol is so happy that the baby did not have to be put in an incubator. Yes. I know who the father is. Sol isn't.*

* * *

*August 4* . . . Dr. Latimer is the peripatetic protagonist of Communism. He must help rescue the world from folly, he must help to destroy the menacing tentacles that reach out towards all men in present day bourgeois society, which, so says the learned man, is of the lowest moral and spiritual stagnation. To be a Communist one must also be an Atheist.

A very successful and very competent cardiologist, the doctor teaches and preaches the Utopian realization of a new order. I stood near him as he sat beside the patient with congestive heart failure. He spoke interestingly of the value of circulation time, vital capacity tests, weight and venous pressure measurements as compared to evaluating the signs and symptoms manifested by the patient.

"Is he better?" tremblingly inquired the patient's wife. The doctor nodded in the affirmative. With folded hands and upraised eyes the wife exclaimed: "Oh, I thank Thee, Lord in Heaven." The learned man regarded her disdainfully. "Some day," he addressed himself to me, "there will be complete decay in religious belief. With the increased comprehension of the elements and of evolution the narcotic called religion will become extinct. Tell me why does the Lord deserve thanks because this man is better. I do. And I didn't make him sick." He placed his arms akimbo and paced the room. "Primitive man found explanation in malign spirits and he would bribe and outwit those spirits. Now man pleads, promises and lies to something unseen and unknown. Why should man's journey through life be determined by something that I know does not exist. In the days when religion dominated mankind, man suffered from the cruelest despotism."

And now, doctor? In the countries where religion has become extinct and Communism reigns over the bodies and souls of men, does not the imagination falter before the spectacle of cruelty? Does not the excuse of harsh necessity reduce man in those lands to the level of a robot? And why, doctor, should you be a fanatic of a move-

ment, and yet condemn fanaticism, even pure belief in a Supreme Being? Life is always extraordinarily well adjusted to the kind of world one lives in. Wouldn't you benefit humanity much more by concentrating your fine mind on your work?

*I indulged in one of my hobbies—listening. I went outside and leaned against the wall of the hospital. The fog was thick and the night an inky blackness. I heard a woman's voice: "I am afraid. It's so dark." The man: "But I am with you." The woman: "That's why I am afraid. Yes, yes, I know you. That makes it worse." She ran into the corridor of the hospital. A strikingly attractive girl.*

*Soon I recognized the voices of eccentric philosophy teacher Walden and that of his wife. Evidently they were robbed in the darkness. The couple forms a fine example of marital disenchantment. She calls him The Lost Illusion. From him: "A strange, ungrateful creature, that's what you are. Aren't you thankful this was the first time we were ever held up? Aren't you going to offer up thanks that the thugs took our money and spared our lives? Aren't you overjoyed that we had that much money and no more, and aren't you—." "Dry up," she commanded. And there was silence all around.*

* * *

*August 10* . . . There were the classic symptoms of intracranial pressure due to brain tumor located in the posterior fossa in a little girl of nine. There were present the characteristic papilledema, occipital headache radiating to the neck, and vomiting. Visual acuity was not changed. She was admitted to the hospital because of convulsions. Neurosurgeon Walter operated on her. I don't know why mental symptoms of intellectual deterioration, confusion, memory impairment, dullness, and loss of initiative began after the operation. Dr. Walter is being sued for a huge sum. The complaint states the child became mentally unbalanced because of the operation.

The lawyer for the plaintiff began to implant into the minds of the jury the conviction that the girl never needed an operation, and that she was used as an experiment. With a few typed pages before him the lawyer spoke with such dispassionate serenity, his words were delivered with such pace, verve and drama, full of color and interest that the neurosurgeon almost began to believe it himself. Of a sudden the legal genius flung the typed pages aside, and as he began to speak extemporaneously he converted himself into the typical jackass. He turned on all taps and began to denounce the medical profession. He called all doctors, and especially brain surgeons "nuts," and then tried to be funny. "We should be thankful to the doctors. They kill us today, so we won't have to die tomorrow. Yes. They bury their mistakes. But here is one mistake they could not hide."

He suddenly noticed me among the audience. "Gentlemen of the jury," he screamed, "look at this doctor." He pointed at me. "Look at him. Last week my intimate friend Frank Gould had a slight case of indigestion. He sent for this doctor. When he left, Frank was dead."

As I became the center of attention and as a few necks were craned to look at the killer I walked out, accompanied by a few hisses. And who faced me in the corridor? Mrs. Gould. "I was at your office to sign these here blanks for that there insurance company. They told me you were here. Damn it. I have so much trouble with these here insurance blanks that I am beginning to be sorry that Frank is dead." At the present writing the case still goes on.

* * *

*August 13* . . . From soft spoken, dignified Mr. Gassner: "You know my father-in-law. Yes, you do, the one who works in that storage plant. Well, his doctor told him that he suffers from chronic poisoning of carbon dioxide. That doctor says that my father-in-law is exposed to sublethal doses of that stuff. Now what is sublethal? Oh, I see, almost fatal—" he lowered his voice to a whisper—"look. Do you know a way of making it real fatal? He is heavily insured. There is plenty in it for you—."

* * *

*August 18* . . . Fatal. Dr. Coates was visibly unhappy and very much confused. His patient became wildly excitable and uncontrollable as the doctor was removing the esophagoscope. A few minutes later his patient was dead. The doctor addressed himself to the patient's wife, forgetting that he was talking to an unlettered laywoman. "You see, the ending was fatal. He may have developed mediastinal emphysema, and the result was a rupture of the mediastinal pleura. Whether the pneumothorax was secondary to perforation of the piriform sinus or was spontaneous is hard to tell." "Is that good?" she asked indifferently, "thanks, doc." "Madam," the doctor spoke agitatedly, "I said his case ended fatally." "Fatally, smaitally, so it ain't dangerous." She was in a happy mood, and as someone called me by name she turned quickly. "Oh, so you are that doctor? I thought you looked different." I said, "Did you imagine me short and ugly?" She laughed. "No, I thought you were tall and handsome."

* * *

*August 23* . . . As I practice.

Spoke elderly Dr. Boles: "Efforts to prevent conception are widespread." His young wife interrupted: "You certainly need no efforts to prevent it, do you, dear." The way the word "dear" was uttered is still ringing in my ears. A type all by himself this good Dr. Boles is. He comes to the clinic daily but each morning he interrupts the work with some new joke. Just where he picks them up I don't

know. Today's joke was: "Hey, men, does any one of you know the difference between crime and prostitution? No? Well, crime does not pay."

Received five expensive shirts, half a dozen costly neckties and a tie clasp from bricklayer James Harcourt whom I have never seen. His uncle recently died of pulmonary embolism. "Dear Doctor," said the note, "you made me the happiest man in the world. My uncle made me beneficiary in his twenty thousand dollar policy. Gosh. You did a quick job. Thanks again."

*Samuel Samuelson's gastric ulcer followed a second degree burn—not at all an uncommon occurrence. "Your ulcer came from your burns," I told him. "You mean from your salve you gave me for those burns. No, no. I don't want to sue you, unless I have to. I just hate court suits, and I hate juries. What's a jury? Just men to decide who has the better lawyer. I'll tell you what. Let's settle it out of court. Just give me a paltry five thousand and we'll forget the whole business. Just five thousand. That's all." "That's all," piped his wife.*

*Two colleagues. Two cases of chickenpox next door to each other. Both patients developed auriculoventricular block. One doctor is accused of having caused the trouble by the medicine he gave (penicillin); the other because he gave none.*

Elderly, unattractive, pimply, thick-lipped Mrs. Chades, with protruding yellow teeth and odor not so sweet, suffering from dysphagia, refuses to go to the gastroenterologist I referred her to because his wife is away and she trusts no doctor though he is very good on the stomach. "Those stomach specialists, they all make love to me." Poor specialists.

*August 30 . . . Such is the practice of medicine. The woven fabric of my dreams of the long ago when I just started out are dull alongside the vivid color of actuality. Then I didn't know there is such a host of enigmas and cheats and men of offensive, insupportable arrogance. Sometimes I find man hard to understand. Sometimes the world and events look to me like a somnambulistic procession. No one knows whither or why. Yet my faith in the dignity of men was never lost. There is always a taper of light in dense darkness; and while there are beastly creatures in human form, the vast majority of men and women are humane, good and honest, and some of them even pay their medical bills. What else can one ask?*

INTERNATIONAL ASSEMBLY

Public Auditorium

Cleveland, Ohio

November 9 to 12, inclusive, 1948

Thirty-third Year